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JANUARY

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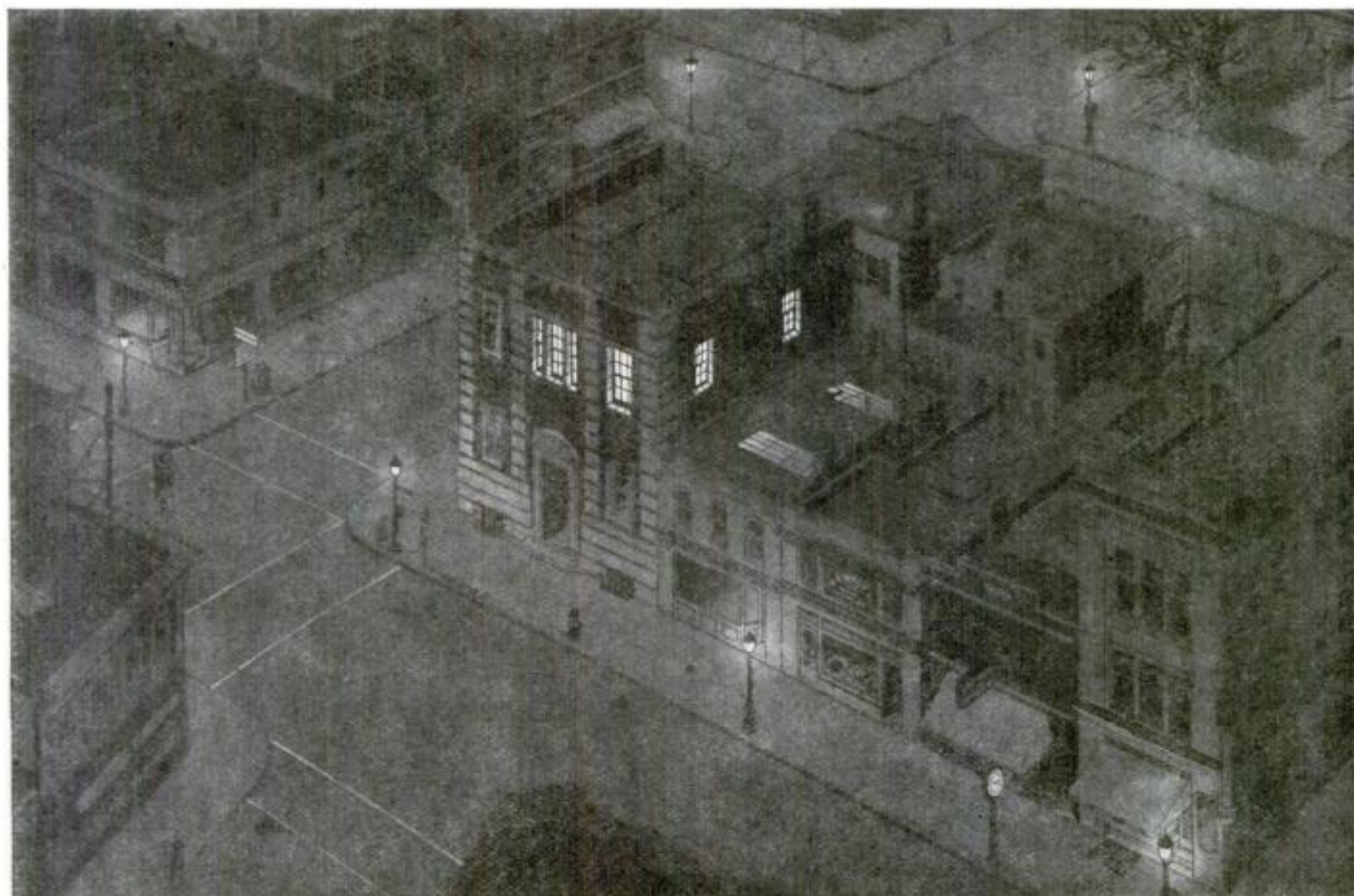
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NIGHT comes on and spreads a blanket of darkness upon sleeping cities and towns. Here and there a lone policeman. In the distance a clock tolling the hour.

In the dark silence of the night, there is one light forever burning . . . one voice that is never stilled. That light is the light in the telephone exchange. That voice is the voice of your telephone. A city without telephones would be a city afraid—a city of dread.

For the telephone brings security. Its very presence gives a feeling of safety and nearness to everything. In times of stress and sudden need it has a value beyond price. In the many business and social activities

of a busy day it is almost indispensable.

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# POPULAR SCIENCE

FOUNDED MONTHLY 1872

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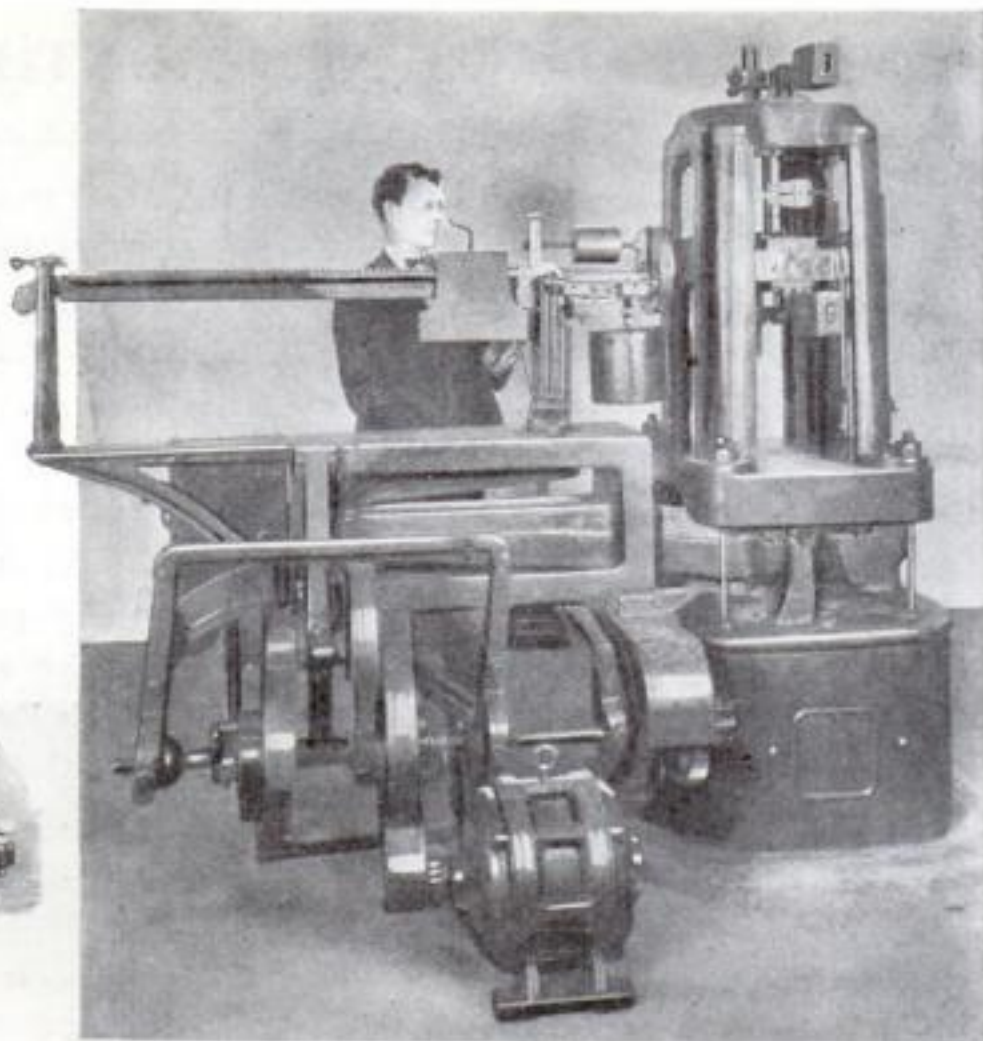
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*In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions*



**I**N THE giant machine, right, at the Popular Science Institute, bolt clippers are tested. A scale registers the force necessary to crush jaws. Below, member of Institute staff testing pliers



# TESTS that Guide Wise Buyers

By R. M. Bolen  
Secretary, Popular Science Institute

**Y**EARS are literally compressed into minutes at the modern tool testing laboratories of the Popular Science Institute. Here, almost human machines tell accurately, in a few minutes, facts that years of usage would only partially disclose.

Hammers are carefully tested, pliers are scientifically approved, and screw drivers are tried under the severest of conditions. So complete is the engineering equipment at these laboratories, that any buying advice given out by the Institute may be depended upon as being authoritative.

For nine years, Popular Science Institute has offered to our readers the advice of experts in several technical fields. It has made a careful investigation of virtually all the nationally sold products in the classifications of equipment in which POPULAR SCIENCE MONTHLY readers have shown the most interest.

Many products go through the hands of several testing engineers before they are approved. In the case of tools, the hardness of the metal will be investigated by one expert while others test other characteristics.

To do this special testing machines are required. For this reason, the Popular Science Institute tests are conducted in the well-equipped Sage Research Laboratory at New York University, where more than \$300,000 worth of testing equipment is available.

In the radio laboratory, receivers are subjected to telltale trials in which a loudspeaker is never used. Tiny indicators on

electrical measuring instruments tell the story. By these, the engineer in charge can determine definitely and accurately whether the particular receiver he is testing will give a throaty gurgle or a faithful reproduction of the music and voices that are broadcast. Signals to test radio receivers have their source in a miniature broadcasting station right in the laboratory, as outside signals might vary in strength and thus prevent conclusive results.

Each year many new radio sets are placed on the market and the wise buyer will take advantage of the reliable advice Popular Science Institute offers him. Recently, to make even more elaborate tests, part of the scientific radio equipment has



been inclosed in a small wire-shielded room. A double layer of wire screen serves to keep out all electrical interference.

The great value of the Popular Science Institute recommendations is shown by the fact that Professor Collins P. Bliss, Director of the Institute and Dean of the College of Engineering at New York University, has been called upon repeatedly by Government authorities at Washington to assist in projects where information accumulated by the Institute proved useful.

To obtain really helpful and accurate information regarding oil burners, the Institute conducted a nationwide survey of oil heating installations. Investigators were sent into 1,500 homes where oil burners were installed and 1,500 other owners of oil heating devices were questioned by mail. The combined tabulated results presented a clear picture of the satisfaction oil burners were giving.

Besides issuing carefully compiled lists of approved oil burners, radios, and tools, the Institute has also prepared books and bulletins which present accurate facts on heating and ventilating, insulation in building construction, oil heat, and air conditioning. The printed matter available from the Institute is listed on this page.

The Institute advisory service is available to all readers. Questions regarding oil burners, tools, radio sets, and approved lists should be addressed to the Popular Science Institute, 381 Fourth Avenue, New York, N. Y. Be sure to inclose a self-addressed and stamped envelope.

## INSTITUTE BULLETINS

Heating and Ventilating\*  
Insulation in Building Construction†

Advice on Installing Oil Heat  
Air Conditioning Bulletin†  
List of Approved Oil Burners  
List of Approved Radios  
List of Approved Tools

\* 25 cents each † 6 cents for postage

The remaining bulletins will be sent upon receipt of a self-addressed and stamped envelope.



Merry  
Christmas



Oh...what a Santa Claus  
you can be this year!

Santa Claus... down a chimney? No, she's found out there's no such man. Not a jolly white-bearded old fellow who gives things to you, but a lean old man—"Hard Times"—who steals everything away. *Show her—show her it's a lie!*

The Welfare and Relief Mobilization for 1932 is a cooperative national program to reenforce local fund-raising for human welfare and relief needs. No national fund is being raised; each community is making provision for its own people; each community will have full control of the money it obtains.

*Give* through your established welfare and relief organizations, through your community chest, or through your local emergency relief committee.

*All facilities for this advertisement have been furnished the committee without cost.*

*Newton D. Baker*

Newton D. Baker, Chairman  
National Citizens' Committee

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JANUARY, 1933



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# PAINLESS WAYS of Saving Money

By LEON MEADOW, *Financial Editor*

THE story of Thomas Edison's ex-  
haustive search for the correct  
material to use as a filament in his  
experiments on incandescent bulbs, makes  
a splendid "moral" for this article. Young  
chemists in his employ were told to try  
every substance upon which they could  
lay their hands, to pass up nothing before  
giving it a trial. Sometimes these young  
men would balk. "You can see this mate-  
rial couldn't do the trick," they would  
say. Edison's answer was invariably the  
same—"I don't care how you go about it,  
what you try or don't try, how foolish the  
experiments look or what your methods  
are. All I'm interested in is the result."

I don't know whether or not Thomas  
Edison applied the same reasoning to the  
business of saving money, but I do know  
that it is a rule which will certainly repay  
the man who follows it. Methods and  
places for savings are innumerable. Many  
people adhere to a budget plan of one type  
or another. We all know people who fol-  
low no other plan but that of convenience,  
merely putting away varying sums of  
money when the spirit so moves them. As  
far as places are concerned, there are those  
who use the savings banks, others deposit  
their funds in building and loan associa-  
tions. Some keep them in socks, shoes and  
cupboards. The one important thing is  
that they save money. How and where is,  
after all, of secondary importance.

Concerning the ever fascinating subject  
of saving money there is one thing that  
amazes me above all else. That is the  
ingenuity which men develop under the  
pressure of circumstances, and by cir-  
cumstances I mean hard times. Let me  
illustrate this point. The other night, rid-  
ing home on the train, I found myself  
next to a man whom I know quite well.  
As the holder of a responsible position in  
a large firm, and as the father of two chil-  
dren he has certainly had his share of  
worries in the last two years. We were  
talking about saving money.

"SAVING is a habit I formed early, long  
before I was married," my friend told  
me. "It is one that I cannot and do not wish  
to break, although I certainly have reason  
enough to do so these days." And he did,  
I reflected, for I knew that in the last two  
years he had taken three successive cuts in  
salary, totalling in all a reduction of al-  
most thirty-three and one-third percent.

"My wife and I," he continued, "have  
lived according to a budget plan which we  
mapped out a good many years ago, and  
a plan which has enabled us to save a nice  
sum of money over that period of time.  
I'll admit it got harder as the children  
grew up and our interests started to broad-  
en out. Then came my first cut in salary.  
It amounted to 15%, and this, together  
with increasing family expenses, virtual-  
ly wiped out our weekly surplus. Since  
that cut I have not been able to put a cent  
away in the bank, as scheduled in the  
savings account department of our budget  
plan. Yet, in the last two years I have  
saved \$400."

"Hold on," I said, "you just told me  
you couldn't put a cent away, and now you  
say you saved \$400. What are you trying  
to do, kid me?"

"No, I meant I couldn't save according  
to budget plans, but I found another way.  
I never spend a penny or a dime."

"What do you mean?" I asked, visualiz-  
ing some new kind of miser.

"I mean," he replied, "that if I want to  
buy a pack of cigarettes for fifteen cents,  
and I find myself with forty cents in  
change—consisting of a nickel, dime and  
quarter, I break the quarter. If I get my  
change in a ten cent piece, I then have  
two of them. When I get home at night,  
first thing I do is throw those two dimes  
in a little bank. I do the same thing with  
pennies."

I was surprised, to say the least. This  
amounted to making a game out of saving  
money. But, as I said before, it's the re-  
sult, and not the method, that counts. "Do  
you mean to tell me," I asked, "that you  
saved \$400 in two years by doing that?"

"THAT'S right," he said. "It averaged  
\$200 a year, and I'm perfectly sure  
that it will again average as much this  
year. Don't get the idea, however, that  
I'm a fanatic about this thing. Carry-  
ing it to an extreme would rob me  
of the pleasure I get from doing it, and,  
you know, it is a lot of fun. If I'm wait-  
ing in line to get into a bus or subway  
and I have a dime, and a ten dollar bill  
in my pocket, I won't hold up everyone  
by demanding change. But under ordinary  
circumstances I refrain from spending a  
penny or a ten-cent piece. You can call it  
a painless or a funny way to save money,  
but nevertheless (Continued on page 7)



## PAINLESS WAYS OF SAVING MONEY

(Continued from page 6)

it's helped me beat bad times. I knew it would be virtually impossible to deposit five or ten dollars a week in the savings bank. Yet, here I am, saving \$200 a year, and actually not feeling it!"

"I don't think it's funny," I replied. "On the contrary, I think you've done a rather remarkable thing. What's the difference how you save, so long as you save? But, tell me, what do you do with this money?"

"I put it in the savings bank every six months. Just before Christmas I withdraw some of it and give it to the children to use for buying their Christmas presents. The rest of it stays there."

The train pulled in at my friend's station, and he got off. I was left alone to my thoughts and newspaper. But the latter went unread because I simply could not help thinking about this funny way of saving money. And yet it was no funnier than it was effective. Certainly no one could sneer at a saving of \$200 a year in these times.

By the time I got to the office the next morning I had decided to do a little further investigating on this subject of money saving methods. I called up various savings banks, but no information was available. Yet, in the course of the day, I managed to unearth a few more examples. For instance, I ran across a man who used the same method, but on a more elaborate scale. He never spends a fifty-cent piece! He told me an interesting story in connection with his scheme, which he has practised for the last year and a half only.

"THIS past summer," he said, "my wife and I were anxious to send our boy to camp, or rather to send him back to the same camp, as he hasn't missed a summer in the last five years. He had had a slight attack of pneumonia in the winter, and he needed building up badly. However, bad times have made no exception of our financial standing, and it seemed to be an absolute impossibility to spare the money. In looking around for the money I thought of my special savings account and thought maybe I had enough there for the camp tuition. Every few months I take all my fifty-cent pieces down to the savings bank and deposit them in a special account. I never paid much attention to the bank book, because I've always looked upon this crazy method as a hobby rather than as a means to an end. The bank keeps the book on this special account, so I asked my wife to go down and see how we stood.

"As soon as I got home that night, my wife loosed a verbal attack on me. 'Say,' she said, 'what have you been doing—holding out on me?'

"What do you mean, what are you talking about," I asked.

"You know what I mean. That special savings account of yours had \$677 in it. That means camp for Johnnie this year."

"I was just as astonished when she told me that, as she must have been when she found out how (Continued on page 8)

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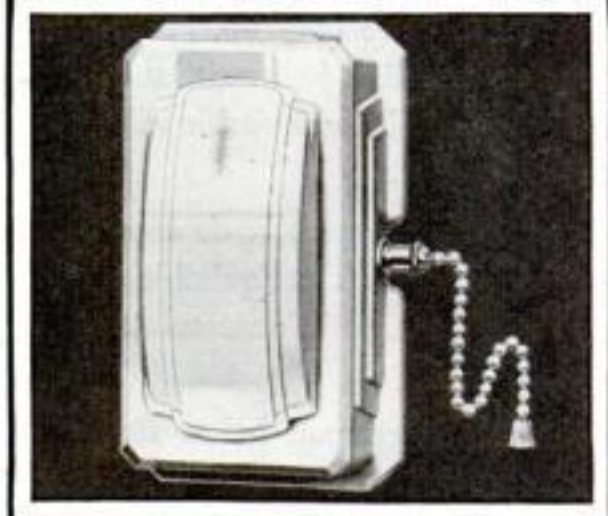
AGE

ADDRESS





## For the nights AFTER CHRISTMAS!



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## PAINLESS WAYS OF SAVING MONEY

(Continued from page 7)

much we had down at the bank. Not astonished at the amount, but surprised that any such peculiar hobby should result in so practical and beneficial a savings method. Call it crazy if you want, but you can't argue with figures, and \$677 speaks for itself."

The word "crazy" was furthest from my mind. After the "penny and dime" story I was ready to believe almost anything. In fact, the only thing left for me was to wonder at man's ingenuity. But I still had one more surprise in store for me.

That same afternoon a man came in to see me about a financial matter, and in the course of the conversation, I had occasion to mention these unusual money saving methods. He didn't seem as surprised as I thought he should have been. This is why:

He knows a man who, when he was a baby, received from some relative a silver dollar coined the same year he was born. That man kept the dollar and, incidentally, still has it. Almost ten years ago he decided that it would be a rather amusing hobby to collect and keep all the coins he came across that were minted the year of his birth, which was 1884. Sounds like just an amusing pastime, or a sentimental whim, doesn't it? Well, he has quite an extensive collection now—and it happens to be worth nearly \$4,000. And I don't mean collector's value, either. I mean \$4,000 in current actual value, as represented by the denominations of the coins. Unfortunately for him, he incurred an unforeseen obligation last spring. The only possible way of meeting it was by dipping into his collection. Fortunately, he had that collection, and it had in real cash, face value.

I THINK I might search for a long, long time, and never find an odder way of saving money. But no matter how queer a story turned up, I believe I would always feel the same about it. Any honest method, whether it appears funny or works like a game, that accomplishes the purpose of saving money is a good method.

The one thing that appeals to me about these amusing experiments is that they encourage the saving of money, without laying down any hard and fast rules such as a budget demands. Once the budget rule is broken, people find it difficult to get back into stride again. On the other hand, those who use the above methods break their rules every day, since it isn't possible — unless one is fanatical about the thing — to do otherwise. But here the breaking of a rule isn't so serious a matter; there's nothing to be made up, and consequently it's easier to start saving again.

Don't believe for a minute that this argument suggests a substitution of these unique savings methods for those employed in all budget plans. The latter deserves and has earned its proper place in everyone's financial picture. My point in writing this article is merely to show how people, reacting under economic pressure, become ingenious (Continued on page 9)

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POPULAR SCIENCE MONTHLY



## PAINLESS WAYS OF SAVING MONEY

(Continued from page 8)

about savings problems; how they get around all the mental hazards of bad times and still manage to save money in ways that don't make them feel as if they have to go without one meal a day to do it. The budget itself has a different and larger place in the financial scheme of things. In fact, it is large enough in scope to adequately and comfortably embrace any of the above savings methods. These painless ways of saving money can be worked into a budget system easily, and with happy results.

### To Help You Get Ahead

THE booklets listed below will help every family in laying out a financial plan. They will be sent on request.

**The Investment Aspect of Life Insurance**, by M. A. Linton, presents life insurance as an exceedingly worthwhile investment as well as a form of protection. Provident Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

**Before 65 and After** explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York City.

**How to Get the Things You Want** tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

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# Our Readers Say



## Now, You Old Dog Hater, Will You Behave Yourself?

As a dog-lover, I rise in defence of my canine friends. R. G., New York, evidently is one of those individuals who would eradicate those who suffer with tuberculosis in order to stamp out the disease. As for the hydrophobia scare, bad human teeth cause much more trouble. R. G. has a fist-sized piece of ice where his heart should be. Dogs and men have been comrades for hundreds of thousands of years. In return for decent treatment, these "noisy, dirty, flea-bitten beasts," will give their lives for the master whom they serve.

The faithfulness and devotion they lavish upon mankind is out of all proportion to what they receive in return. Dogs have been known to starve themselves for grief at their master's death, and to travel thousands of miles to find a master who had deserted them. A man must be deaf and blind who has not seen or heard some testimony of the devotion of the dog to mankind. Must we destroy them all, because some of them become ill? Perhaps at some future date, when mate and friends are gone, R. G. might be glad to have the affection of some dog, besides the consolation afforded by his pipe and his book. The worst punishment one could wish for him is that he shall never know such affection. —J.C.Q., South Manchester, Conn.



## This Back Seat Driver Wants a Crucible Furnace

If I may be permitted to change the name of your department, "Our Readers Say," to "Back Seat Drivers' Forum," I will climb into the rear seat and begin prodding the harried driver by expressing my approval of your article "Casting Small Metal Parts" in a recent issue. May we hope for an article in this series devoted to a small crucible furnace? A crucible, a few fire bricks, a little fire clay and an old vacuum cleaner motor will turn out quite a crop of foundrymen. —F.P.H., Pocatello, Idaho.

## Before You Get This Solved, the Bubble May Burst

I AGREE with G.N.P., of Connecticut, that there should be more and better problems in mathematics in our magazine. Just in case G.N.P. hasn't, as yet, been satisfied with those that have been published, I suggest that he start work on this one, which may serve to while away the winter evenings—many of them: A spherical soap bubble is being inflated at the rate of two-tenths cubic inches per second. Find the rate at which the radius is increasing when it is one and one-half inches long. —A.P.B., East Lynn, Mass.



## The Winding Old Passaic Runs Its Coils Around New Jersey

WHILE on the subject of crooked rivers, kindly permit me to enter the Passaic River of New Jersey as one of the most promising candidates for high honors. It is 128 miles long; but the distance between its source and its mouth is only seventeen miles. Moreover, through its whole course, it indulges in twists and contortions that would arouse the despairing envy of the most agile serpent. One of its coils makes a complete horseshoe around the City of Paterson; and there are other twists of almost as extreme a nature. Beat this, if you can! —J.F.M., Paterson, N. J.

## Sailors Can't Swim But How About Your Cats?

I READ with much interest the article by Randy Enslow, "Out of the Air on a Bag of Silk," but there was something he said that I considered "out of whack." To quote his own words, "Knowing how to handle a parachute and make a jump is as important as knowing how to swim is to a sailor." Believe it or not, this strange fact is true: Ninety percent of sailors can't swim. So if the author wants to impress on the minds of the many sailor readers the importance of the parachute, he should have said, "knowing how to handle a parachute and make a jump is as important as knowing how to ride a horse is to a cowboy." Some of you landlubbers and air sailors may say this ninety percent stuff is all hokey but I can state this strange fact with quite a bit of authority as I am a sailor and my dad has been one for over thirty years, and although we are both good swimmers, we have found that the majority of sailors can't swim. Most sailors hate the water, or at least the actual submersion in it, worse than a cat. Now, you landlubbers, maybe here is something you can catch me up on. Maybe cats don't hate the water, but I hear they do. —B.E.G., Vancouver, B. C.



## Your Ladders Show Street Is 26 Feet in Width

THE leaning, intersecting ladder problem submitted by G.N.P., of Meriden, Conn., in which it is required to find the width of the street, presented few real difficulties. I find the answer to be 26 plus feet which is the distance from building to building. Give us more. —J.J.S., Sea Side Park, N. J.

## Constant Reader Wants More Motorbike Stuff

I HAVE been a constant reader of POPULAR SCIENCE MONTHLY for the last six years, and would gladly give my last fifteen cents for a copy. I enjoy the aviation and automobile

features very much. I am interested in motorcycling, and wish you would give us some more articles on that subject like those you ran in a previous issue. I should like to see somebody make a cross country ride on a motorcycle, or something on that order to promote interest in this sport. —F.J.L., Houston, Texas.

## Maybe the Adult Workers Stuck to the Alcohol

ONE cold night last autumn, a paper wasp nest was carried into a laboratory at Johns Hopkins University and pickled in alcohol. Later, the interior of the nest was carefully studied. Examination showed there were only 402 wasps, mostly drones and queens, living in the 3,195-cell nest. The adult workers numbered seventeen. This verified the opinion of previous investigators that in the fall most of the worker wasps die. What I want to know is: If the alcohol had the same effect on the wasps it has on pickled human beings, shouldn't the seventeen adult workers have been able to keep the entire Johns Hopkins' faculty on the jump for at least a year? And was the alcohol good for anything when the wasps got through with it? If not, why waste it on the wasps? —F.A., Baltimore, Md.



## Please Consider Yourselves Duly and Truly Warned

As I am a regular reader of your magazine, I am going to ask you to insert a small article warning your readers against all green light shields. Looking through such a shield, you find red lights cannot be seen, with the resulting danger of running past traffic signals. —O.W.G., Rock Island, Ill.

## This City Boy Determined To Be a Real Farmer

I AM an American who intends to return to the States soon and go into the farming game. I am sure the numerous readers of your magazine would be greatly interested in a page or two each issue of practical suggestions on planting crops and raising animals. I have been in Chile for the last five years and the longer I stay away from home the more I appreciate the good old U.S.A. I am interested in farming as I have been involved in numerous enterprises connected with agriculture. The most extraordinary part of all is that I was born and lived in New York City for eighteen years. I am sure there are thousands of other young fellows





who would be glad to go into the oldest and most stable profession in the world, to be a farmer! However, the comparison of farming thirty years ago with that of today is of no practical value, although it makes nice reading.—B.M., Santiago, Chile.

### That Jumping Frog Has Nothing on Leaping Loop

HERE is a question for some unoccupied scientist to answer: Take enough pieces of eight-inch iron wire to make a three-inch core for an electro-magnet. Around this core you wind 100 feet of No. 8 doorbell wire, thus making an electro-magnet for 110 volts. Next, you wind seventy-five feet of No. 8 wire into a circle, fastening the ends together. The inside measurement of this loop is three and three-quarters inches. Place this loop around the end of the magnet. When you turn on the current, the loop of wire will jump from two to three feet into the air. Why does it do this?—K.T.G., Lansing, Mich.



### A Few Brief Words About The Ellipsoidal Hypothesis

THE statement by Sir Arthur Eddington that distant spiral nebulae are receding from us at rates up to 25,000 miles per second, and that the universe is expanding proportionately, verifies the Ellipsoidal Molecular Hypothesis of matter. If we assume as in the Ellipsoidal Hypothesis that the rhythmic impact of a large number of ultimate particles upon the ellipsoidal surface of the molecule maintains both the characteristic shape and density of aggregation to form that substance, then we have to account for the force that must react against other ultimate particles throughout space until balance has been arrived at kinetically. But wherever a continuous force is brought to bear between masses to produce a velocity apart, a uniform acceleration will be increasing this velocity. So that the apparent velocity of recession of the nebulae will increase with time, and this acceleration times the masses involved will represent the total reaction balancing the forces astrally available on the earth. In any case, the observed expansion of the universe must revert to the ellipsoidal formation in matter to formulate a reason for such expansion, more particularly when it can be shown that this expansive velocity increases according to the laws of acceleration with which everyone is familiar.—E.N.B., Donora, Pa.

### Maybe the Spider Got a Fly to Carry One End Across

I AM writing you about a little problem in construction and I hope you will publish this, or an answer to the same, in your magazine as soon as possible. Coming out of the house today, I looked up and saw a single spider web hanging about ten feet from the ground and connected to two trees that stood about forty feet apart. The ends were attached to the trees at approximately ten feet from the ground. The thing I want to know is how the spider got the web across this great distance at such a height from the ground.—M.O.M., Nashville, Tenn.



### It Turns Out Your Field Has 12,710 Square Feet

I HAVE been a reader of POPULAR SCIENCE MONTHLY for a long while, and wish you to keep the magazine as is. In looking over a late issue, I discovered a problem about the area of a certain rectilinear field, by our good reader C.A.P., of Monrovia, Calif. You head the article, "Oh, Feet and Feet and Feet at least—and Maybe more." In solving this exercise, I found the length to be 127.1 feet, and the diagonal to be 161.8 feet, giving a total area of 12,710 square feet.—C.F.M., Drumright, Okla.

### Chief Himself Hands Out Some Delightful Praise

YOUR article, "Spot Crooks by Their Ears" is a real contribution to the science of identification.—Charles H. Sheraton, President, National Identification Assn., Brooklyn, N. Y.

### Surgery Now Cutting Real Scientific Swath

HAVE just finished reading your "Triumphs of Surgery," and I'm all excited and enthusiastic about it. It just happens that a while ago I did some reading on the early history of surgery—about the work of Ambroise Paré and the great Hunter and, of course, Lister. As a result, I wasn't so hot for surgery. Naturally, I knew barbers were no longer surgeons, though a lot of people still call them butchers, and their shops are marked by the red and white surgery poles of a dead age. That is to say, I realized, vaguely, that progress has been made, but Dr. Damrau amazed me with facts showing the colossal strides that actually have been taken by surgery. It's great stuff, and I'll certainly eat up every article Dr. Damrau writes for you—and tell all my friends. In my opinion, every one in the United States should read this series and get wise to the everyday miracles that are being worked by the modern surgeon.—H.L.S., Albany, N. Y.



### Just Goes to Show, You Can't Please Everybody

I HAVE been reading POPULAR SCIENCE MONTHLY for over two years, and I find it most interesting. But lately crime and robberies have taken the place of interesting articles. Let those who stood for prohibition find out all about crime, the organized crime that it created for the benefit of the American people. Couldn't you change those articles on robberies for more interesting ones? Something about electricity, talkies, archeology, wireless telegraphy. By the way, why don't you create a question box, for those who subscribe to POPULAR SCIENCE MONTHLY so they may ask questions and get the answers published?—N.E., Los Angeles, Calif.

### Our Plans Enabled Him To Build Trim Little Boat

WHILE reading an issue of POPULAR SCIENCE MONTHLY some time ago, I saw the plans for a combination sail and outboard motorboat that appealed to me for both beauty and apparent seaworthiness. I ordered the plans and started constructing the boat as soon as they arrived. This was my first attempt at boat building and it was only because your plans are proven plans that my efforts were so successful. I have received many

compliments on my boat building ability and I want you to know that your magazine and plans came in for their share also. The list of materials was correct and the actual cost was within a few dollars of that which was estimated.—W.E.H., Pacific Grove, Calif.

### Let Potato Bugs Sound Their Own Death Signal

HERE's one your farm-belt readers should be interested in: A "potato-bug alarm," has been invented by a student of the College of Agriculture, Cornell University, Ithaca, N. Y. The best time to kill potato bugs is at night when the plants are covered with dew. However, the dew does not form every night and keeping awake to watch for it is hard on us farmers. So the Cornell student has devised a contraption in which the formation of dew closes an electric switch and rings an alarm at the head of the farmer's bed. The only thing better than that would be to have the bugs themselves ring the alarm. At any rate, that would save electricity and the bugs would be no worse off.—H.A.B., Adrian, Minn.



### Still More Short Wave Radio Stuff Is Wanted

I HAVE read Our Readers Say for several years and am a subscriber of POPULAR SCIENCE MONTHLY. This magazine sure takes the cake. Here's hoping that we see more radio dope. Especially beginners' diagrams of short wave sets featuring home made parts, and better still short-cuts in making these parts. Keep on with POPULAR SCIENCE MONTHLY. I am for you.—M.W.W., Industry, Ill.

### It's Hard to Answer a Complaint Like This

I AM very, very dissatisfied. I have been reading my latest POPULAR SCIENCE MONTHLY and now I have finished it and like Oliver Twist I ask for more—and there isn't any more. Though nothing is perfect, Popular Science is nearly so from my point of view. If I had my way, I'd make it about ninety-nine per cent chemistry, with perhaps, a little electricity. I should like to tell P.N.C., Norfolk, Va., that motorcycling has nothing much to do with science. I must thank Raymond B. Wailes for his chemistry department.—W.L., Preston, Victoria, Australia.

### What a Time at Sea for the Poor Sub. Sailors!

I JUST read that the 5,000-ton North German Lloyd liner, Westfalen, will be "anchored" in the Atlantic, 800 miles from land to form a floating air station for planes flying between Africa and South America. The 409-foot ocean oasis will be stationed permanently midway between Bathurst, British Gambia, on the African coast, and the island of Fernando Noronha, off Brazil. That's fine! But just how do you "anchor" a ship in mid-ocean? To what and with what? Probably they send a submarine down and have her crew hang on to the ship's cable to keep her put. I'm just a land-lubber and wouldn't know, but it sounds like horse feathers to me.—R.O.C., Westerly, R. I.







## *Auto Lights Save Planes Lost in Fog*

Drawing by B. G. SEIELSTAD

Summoned by radio, 2,500 motorists lined an unused California field the other day to rescue two fog-bound Navy planes. While the cars' headlights formed an improvised beacon, as shown above, a big transport craft found the flyers and led them to a safe landing. They had gasoline left for only twenty minutes' flying and faced the prospect of diving through the fog to an almost certain crack-up





# POPULAR SCIENCE MONTHLY

January 1933

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RAYMOND J. BROWN, Editor



*By Edwin Teale*

Auto thieves are never active on deserted streets but cars left in busy shopping sections or theater districts, like the one pictured below, are seldom safe from them

With this tool, that can be carried in the pocket, a car thief can often open the door of a locked car



## Auto Stealing

*Now \$50,000,000-a-Year*



**A** BLUE roadster, traveling at high speed, rounded a curve outside a New Jersey town and apparently vanished into thin air.

Five minutes later, two motorcycle cops, flattened against whizzing machines, raced around the corner, flashed past a lumbering furniture van and headed after the stolen car.

Without knowing it, they had already passed it. Snugly housed within the big van, the roadster was already the center of attention of a corps of experts. License plates were being shifted; wire wheels were being substituted for wooden ones; gray, quick-drying paint was being applied to hood and body.

A hundred miles away, across the state line, the van stopped. A light steel runway slid to the ground from the rear of the truck and a gray roadster, with wire wheels and Pennsylvania

## RACKET

license plates, rolled to the pavement ready for sale to an unsuspecting buyer. The latest trick of a motor-stealing mob had worked and the police were baffled.

The detective who told me of this ruse, estimated that the automobile stealing racket in the United States has mounted to a \$50,000,000-a-year business. During the first six months of 1932, 36,000 machines disappeared in seventy-two American cities alone. In New York City, \$2,000,000 worth of cars were reported stolen in 1931.

Syndicates that maintain special machine shops for altering



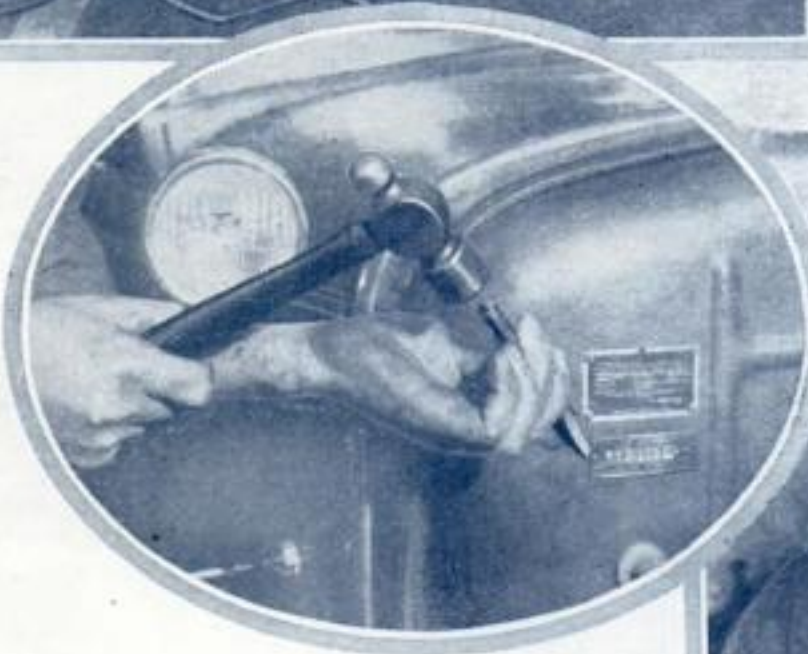


With the apparatus shown below, thieves can make away with a car even when the ignition switch is locked. The device includes a battery and coil. When it is attached to the ignition wires, the car can be started



To change the appearance of a stolen car, wire wheels are put on in place of artillery wheels. Also cars may be "scrambled," several being used, the parts from one replacing those from another

The first thing a car thief does to a stolen car is chisel off the serial number. Secret means of identification now worked out, make it possible for the police sometimes to recognize a machine in spite of this clever precaution



A rush job of painting on the stolen car, using quick-drying paint, changes its appearance so police are unlikely to spot it on the street

stolen cars, motor-theft gangs that steal machines to order, and mobs that dispose of their "hot cars" through chains of subsidized garages operating in small towns are modern features of this gigantic racket.

At the head of every gang, Capt. Edward J. Dillon, for eleven years head of the Automobile Squad of the New York City police, told me, there is a mastermind who does the planning and directing. Under him, specialists form the cogs of a smooth-running machine. The "spotter" or "finder" spends his time picking out cars to be stolen, studying the habits of their owners and choosing the best time for the theft. The "getaway-man" does the actual stealing. Another alters the motor numbers and changes the appearance of the cars before they are offered for sale. This underworld mechanic is known as a "grease ball." In addition, there is a "paper man," an expert forger who prepares the fake bills of sale and the false registration certificates by means of which the purchaser is thrown off his guard when a sale is made.

Such gangs are rated by detectives as among the most slippery of the underworld. Almost every week, some new trick or ruse of these men who deal in stolen cars catches the motorist unawares. One of the slickest of their recent innovations is known as "maceing cars." Here is how it works:

Two prosperous-looking strangers come to town and rent a large showroom on a

prominent street. The next day, they place an advertisement in the local papers: "WANTED: FIFTY SECOND-HAND AUTOS; ALL MAKES; HIGHEST PRICES PAID." Before long, the machines start coming in. Each owner is dealt with in approximately the same way, the dialogue running along about like this:

"How much do you want for your car as it now stands?"

"It ought to be worth \$250."

"Oh, we can sell it for more than that. I'm sure we can get \$300. But, when someone comes in with cash, we have to sell on the spot. Any delay may lose the sale. So, you'll have to leave your keys and papers here. However, to protect you and show our good faith, we will give you a note for the whole \$300 which will be payable at the bank in thirty days."

Delighted at the prospect of getting more than he expected, the owner goes off with the note. Three weeks pass. The showroom is crowded with cars. The partners seem to be doing a thriving business. Then, one morning, the owner passes the place and can hardly believe his eyes. The showroom is clean as a whistle. Every car has disappeared over night!

Members of the gang have drifted into town and stealthily driven the machines

away while the citizens slept, heading in all directions to make tracing difficult. The partners are gone. And, at the bank, the owners get another jolt. The notes are worthless scraps of paper.

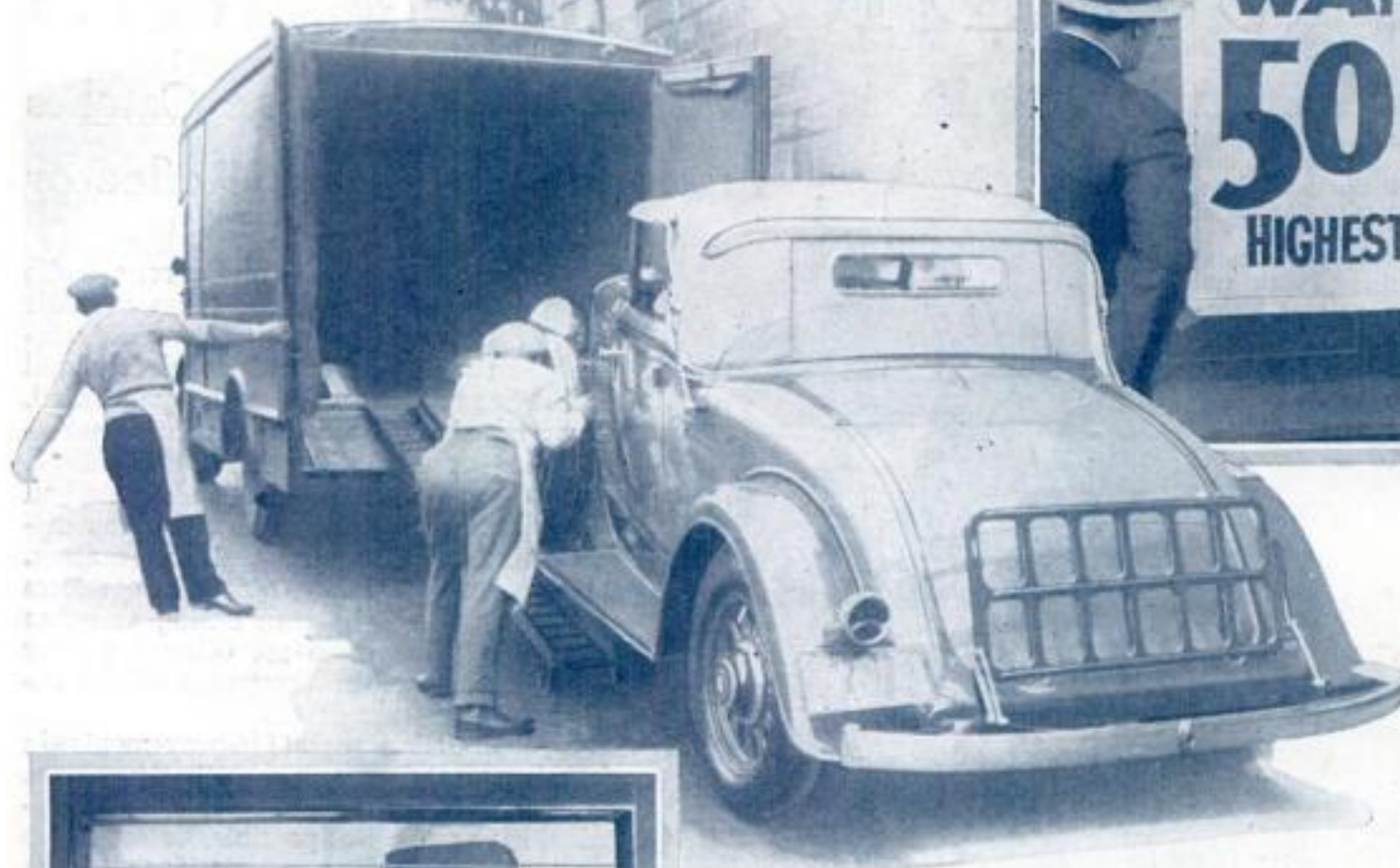
The best part of the racket, from the crooks' viewpoint, is this: Even if they are caught, they face only a civil trial, not a criminal one. According to law, they have not stolen the cars; they have bought them with worthless notes.

Recently, Harold G. Hoffman, Commissioner of Motor Vehicles of the State of New Jersey, reported another ingenious ruse being used by auto thieves. A stolen car is left at one of the small garages controlled by the gang. Some time later, the owner of the garage appears with a large bill for storage and fictitious repairs to obtain permission from the Motor Vehicle Department to sell the machine under the Garage Lien Act. Such permission, when granted, gives him a clear title to the car, making it easy to dispose of. To outwit this strategy, the Department is mak-

## • Using New Tricks and Mechanical Devices,



A stolen car is run up steel tracks into the interior of a big van and so seems to vanish as if by magic. While in the van it may be re-painted, serial numbers removed, and wheels changed



Crooks hire a vacant store and display a sign asking for fifty used cars. Owners are offered even more than they think the car is worth and are paid with thirty-day notes. After a number of cars have been secured, they are spirited away at night



Locking a parked car with the windows slightly open from the top is dangerous as a thief, with a hook like this, can reach in and turn the handle

ing special investigations in connection with all applications of the sort.

Last year the Director of the Chicago Crime Commission, Henry B. Chamberlin, told me of a gang that specialized in stealing cars to order. Chauffeurs acted as agents. When they heard of someone in the market for a certain type of second-hand machine, they would approach him with the story that "a friend" had just such a car which he would sell cheap. Then the mob would pick out the required kind of automobile on the street, steal it, and turn it over to the buyer in a transaction too fast to give him time to think.

Not infrequently, I am told, a gang will place one of its ace "spotters" as a workman in a large garage. In New York City, not long ago, the loss of nearly two dozen cars was traced to the activity of one such inside worker. He would pick out a car and then, during lunch hour, take the key to a nearby locksmith to have a duplicate made. This duplicate, together

with the license number of the machine and the address of the owner, was then turned over to the gang's getaway-man, who had an easy job locating the car and making the theft with his duplicate keys.

Another getaway-man worked as a bellhop in a midtown New York hotel. He would steal away from his post, drive a car which had been picked out to the gang's garage, and then return to duty. If he were suspected, the records at the hotel would show he had been working there at the time the theft occurred. Invariably some such alibi is carefully worked out beforehand.

Probably the cleverest instance of the kind was related to me by a detective friend of mine in Florida. The owner of a car had just entered a store when he heard the motor of his machine start and looked out in time to see it drive away from the curb. He gave chase and the thief was caught two blocks away. Here was his story:

His brother owned a car that looked identically like the one he had taken. He had duplicate keys and permission to drive it at any time. That morning, his brother had told him he would leave the car parked near the store for him to pick up. When he saw the machine there, he was so sure it was his brother's car that he had stepped in without looking at the license plates. Officers brought his brother to headquarters. He verified the story of the suspect just as he had told it.

Continuing their investigations, the police made a remarkable discovery. The two men, they found, were members of a gang that specialized in stealing one make of automobile and the car "owned by the

brother" had been purchased by the gang to provide an alibi in case the getaway-man failed to get away!

What sort of car is most likely to be stolen? The answer is: a medium-priced, well-advertised, popular make of machine. Such cars are in wide demand and consequently easy to dispose of. The particular make of auto that is most frequently stolen varies from year to year, according to shifts in public taste. Thieves keep their fingers on the pulse of popularity and choose machines most in favor at the moment.

Machines with unusual bodies, with strikingly odd-colored paint, and cars that are too old or out-of-date or have an initial cost that was too high or too low, are most likely to be immune from theft. High-priced cars are too hard to sell and cheap cars don't bring enough to be worth taking. Consequently, the thief concentrates on the popular, middle-priced, widely-used makes, favoring new models with the latest equipment.

The zero hour for stolen cars is between eight and ten p.m. More machines disappear then than at any other time during a day. The most dangerous spot in a city to leave your car is the theater district. The center of the shopping section is another risky place. Cars are coming and going all the time and the thief attracts no attention as he drives away from the parking place.

Curiously enough, the bigger the crowd, the greater the danger of your car being stolen! Spots near a stadium where baseball games, prizefights, or wrestling matches are held, are familiar hunting grounds for the auto thief. The assurance that the owner will be gone for a definite length of time gives him the opportunity to use his taped pipes for snapping door locks, his ingenious "jump wire" devices for getting around locked switches, and his big assortment of *(Continued on page 96)*

## Gangs Get Over 36,000 Cars in Six Months •



# New Electric Ears

Buttonhole Microphone Catches Platform — Gigantic Reflector

Left, new velocity microphone in which there is no diaphragm, thus doing away with a source of distortion. Right, speaker wearing buttonhole microphone, with trailing wire, so that his movements on the platform are unhampered by the mike

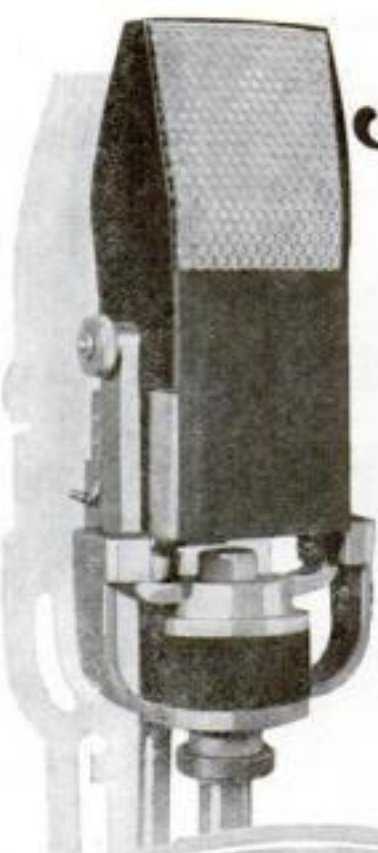
**W**HEN football crowds roar, radio listeners now hear them in their loudspeakers, not as a muffled, distant murmur but as clearly and faithfully as though sitting in the grandstand. When a broadcast is made of a political meeting or any other public assemblage, every speaker on the floor of the hall is heard by the radio public as distinctly as are the platform orators. No need for long-winded announcers to cut in; the man sitting at home beside his radio set often can hear more than the occupants of the expensive ringside seats.

Startling recent improvements in microphones, the electric ears that represent you wherever anything of importance is happening, have made this possible. Latest styles in mikes, ranging from a tiny black button an inch and a half in diameter to a huge bowl five feet wide, have forced old-line technicians to revise their ideas of what can be put on the air, ideas they had acquired because of the limitations of the microphones with which they were obliged to work.

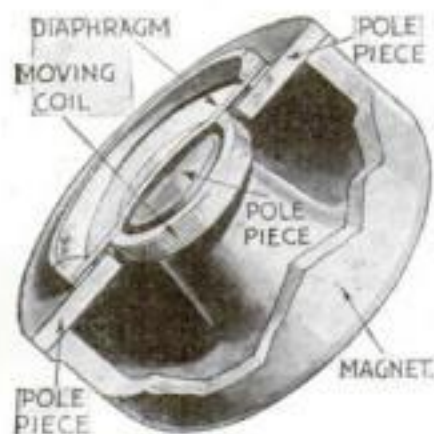
The midget of them all—a curious little instrument known as the lapel, or buttonhole, microphone—has made over broadcasting methods. Some months ago, New York engineers of a great electric company were called upon to solve a problem for public speakers. Lecturers disliked standing in front of a fixed microphone. They wanted to be free to move about the platform without interrupting their discourse. The engineers' answer was a "buttonhole" microphone to be worn in the speaker's coat lapel. Wherever he turned, the button picked up his voice and a small trailing wire carried it across the floor to the amplifiers and loudspeakers. Broadcasting directors were quick to grasp the possibilities of the midget mike.

A rush order brought a supply of them to Chicago on the eve of the Democratic National Convention last summer. Microphone circuits from the rear of the hall were carried along the roof and dropped at six points in the convention hall. At each of these stations, a page boy held a lapel microphone connected to a circuit, and a chart showing the location of each of the state delegations. When the vote of a certain state was called for, the nearest page boy hurried to the leader of the delegation and clipped the microphone on his lapel. He then announced the vote of his state in an ordinary voice, which was heard from coast to coast. Often the radio audience heard the vote before the chairman of the convention, who was sitting right in the hall, heard it.

Since that successful experiment, uses for the lapel microphone have multiplied. An announcer appeared at a recent football game with a pair of binoculars wired for sound. A lapel microphone mounted beneath the lenses enabled him to describe the play without

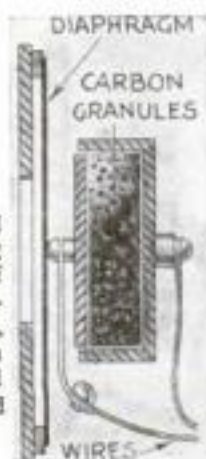


Field glasses with lapel microphone attached to lenses so announcer can talk and watch game



TYPES OF TWO MIKES

Above, simplified diagram showing construction of floating coil microphone. At right, diagram of carbon mike of the kind now generally used



GIANT MIKE REPORTS MEETING

Parabolic reflector microphone put in place to catch the speeches and cheers at big convention



# Multiply Radio's Voice

Speaker's Words as He Moves About  
Type Clearly Reports Crowd Noises

taking his eyes from the players' on the field.

Actors and actresses donned lapel microphones not long ago to add realism to a radio drama. Reading their lines from prepared scripts, they were able to move freely about the studio. It is apparent, the little black button has almost infinite possibilities for it can go wherever its wearer takes it.

In one recent experiment, a noted woman swimmer broadcast her sensations from an aquaplane behind a speeding motorboat, speaking into a lapel microphone that was fastened to the shoulder-strap of her bathing suit, ready to catch everything she said.

Today, however, a microphone can remain in one place and still pick up the voices of distant speakers. Recently perfected for broadcast use is a "parabolic reflector microphone." In it the microphone proper is built into a huge bowl-shaped reflector that focuses the sound upon it. Like a searchlight, the reflector may be swung in any direction and aimed at the center of interest. Crowd noises and band music at football games are now picked up by the parabolic microphone—a more satisfactory and flexible method than the former one of stringing half a dozen or more standard microphones around the field and cutting them in or out as desired. Operas have also been broadcast with the aid of the parabolic mike, which gives a better blending of instruments since it may be placed at a distance from the musicians. Two of the largest parabolic microphones ever built, each five feet in diameter, were used at the Democratic convention by one broadcasting chain. A special concrete mold, weighing half a ton and shaped like a bird bath, served as a form for their construction.

**N**EW fidelity in sound reproduction is claimed for the "moving coil microphone" and the "velocity microphone"—both fresh from the laboratory. They operate like dynamic loudspeakers in reverse; the moving element, vibrated by sound waves in a magnetic field, generates electric current that reproduces the sound. The velocity microphone is remarkable in that it has no diaphragm, thus disposing of a source of possible distortion in the "carbon-grain" and "condenser" types in general use. Meanwhile these standard types are undergoing marked improvement that adapt them for new and amazing purposes. For instance, they make audible the heart beat of a patient during a major operation. They report dangerous strains in the masonry of big dams. They tell of the activity of machinery in great factories. In case of war, they would warn of the approach of an enemy ship while it was still forty miles at sea. So sensitive are they, that experts listening to them, could tell whether the vessel, still far beyond the horizon, was cruiser, battleship, or harmless merchantman and in accordance with this information take the proper steps for defense.



GRAND OPERA  
BROADCAST

Parabolic reflector microphone being focused by engineers and program supervisors so that it can pick up and carry to the radio audience grand opera music

DURALUMIN  
DIAPHRAGM

METAL  
PLATE

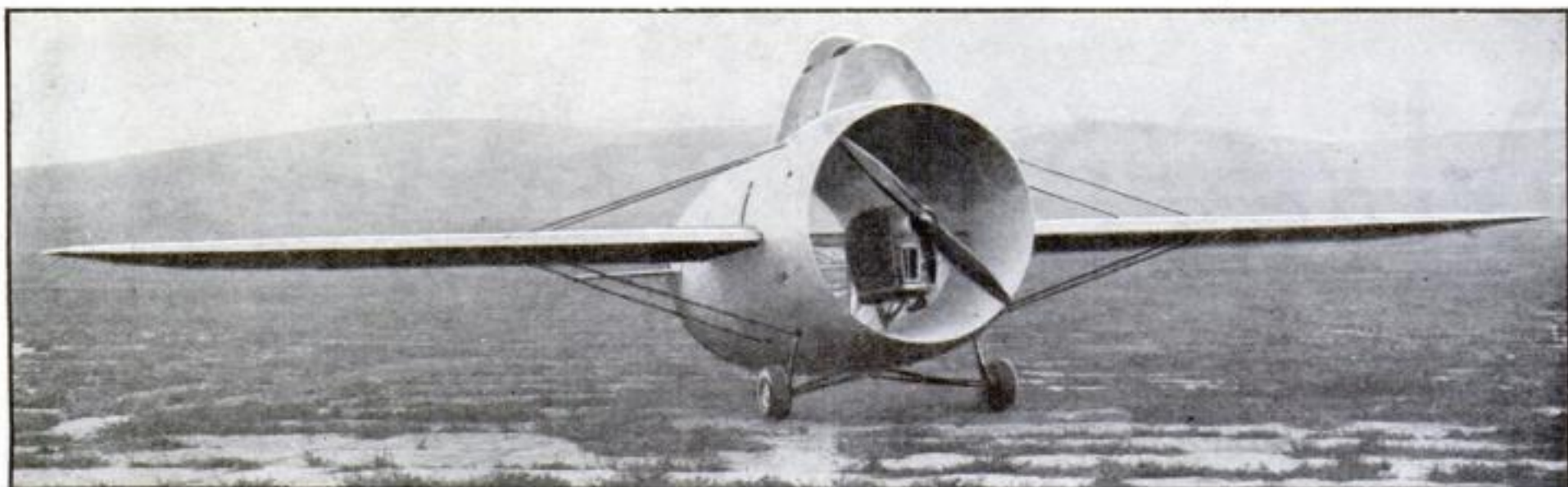


Above, condenser microphone as it is used in a laboratory. At its left, sketch showing basic principles of this mike. Sound waves vibrate diaphragm and thus change the electrical capacity of the condenser

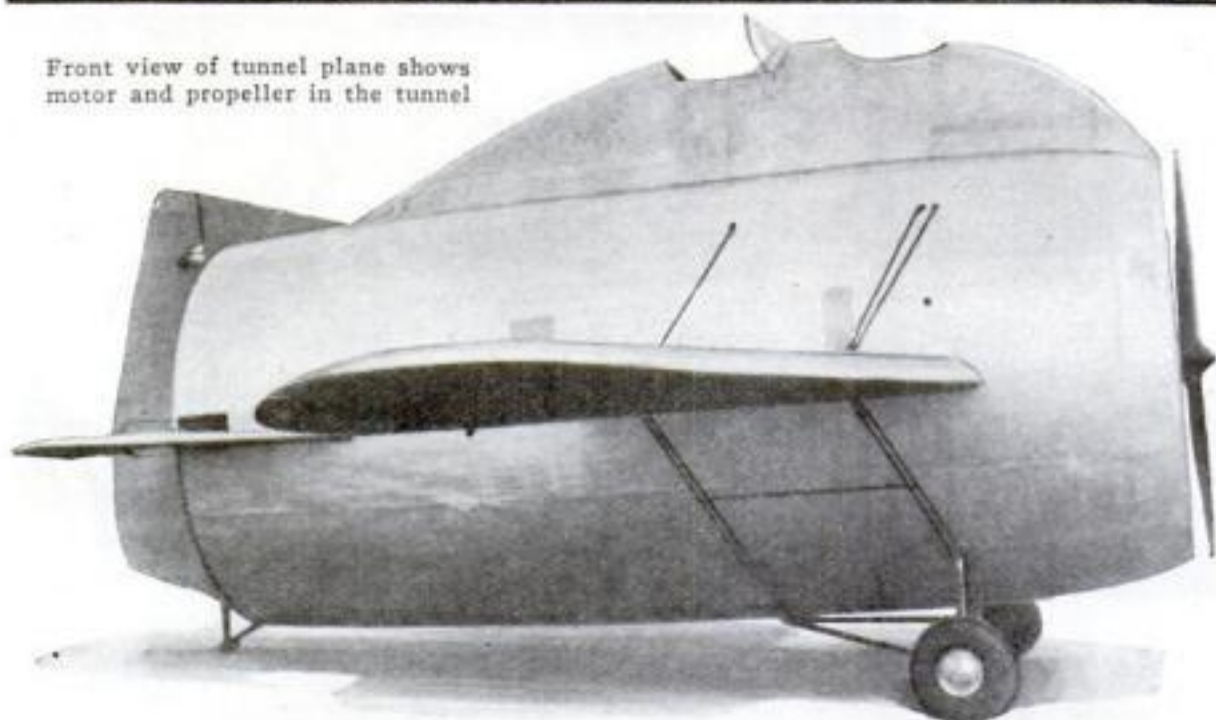


In operating room and clinic, the microphone is replacing the doctor's stethoscope so that beat of heart can be heard more distinctly than was possible by former methods





Front view of tunnel plane shows motor and propeller in the tunnel



Side view showing the pilot's tiny cockpit astride the plane's tunnel fuselage

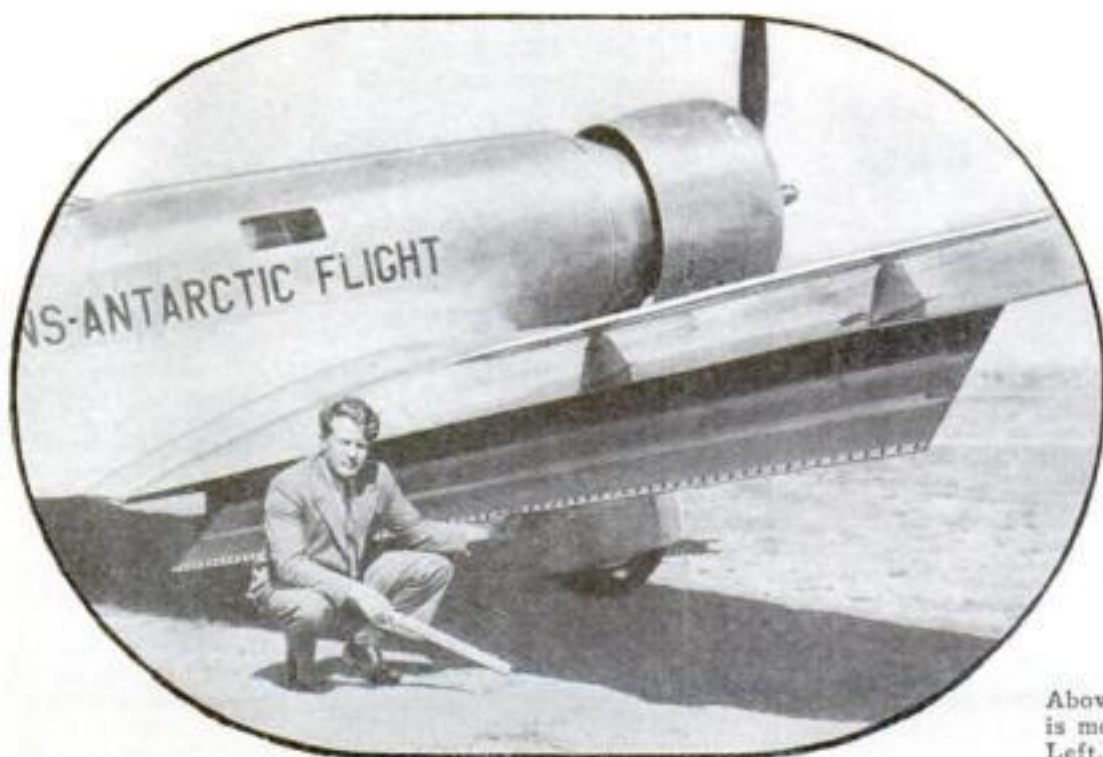
## NEW ITALIAN PLANE HAS TUNNEL-LIKE FUSELAGE

Fit a hollow, wooden cylinder with wings and a propeller and you will have something resembling a flying tunnel that has just been built and successfully flown by an engineer of the Caproni airplane works in Italy. The pilot sits in a tiny cockpit astride this strange machine, while motor and propeller are mounted within the tunnel-shaped fuselage. According to the inventor, the plane's radical design utilizes the propeller's thrust to maximum advantage. Since the slipstream of the propeller does not impinge upon wings or fuselage, there is little retarding drag; but the tail control surfaces are exceptionally responsive. With the success of his first two-seater, 120-horsepower sport model, the inventor sees future application of the design to much larger aircraft with far greater carrying capacity.

## Air Brakes for Planes Greatly Reduce the Landing Speed

Air brakes for planes have appeared on some of the newest machines, following the success of the innovation in tests. Hitherto pilots have resorted to the risky practice of side-slipping to avoid overshooting a landing space of limited area. The new air brakes, consisting of expanding fins designed to create an air drag, slow down a plane and enable it to settle safely to earth at far less than its usual landing speed. One type, designed by a California inventor, is mounted on the wing struts. Its two halves when closed form a streamlined profile like

a wing, and unfold to present a broad impeding surface. Another style, hinged to the trailing edge of the wings, has been installed on the big metal monoplane that will carry Lincoln Ellsworth, noted Arctic explorer, and Bernt Balchen on a projected 3,500-mile flight across the Antarctic over unmapped territory. It will insure safe landing on runways in the polar ice.



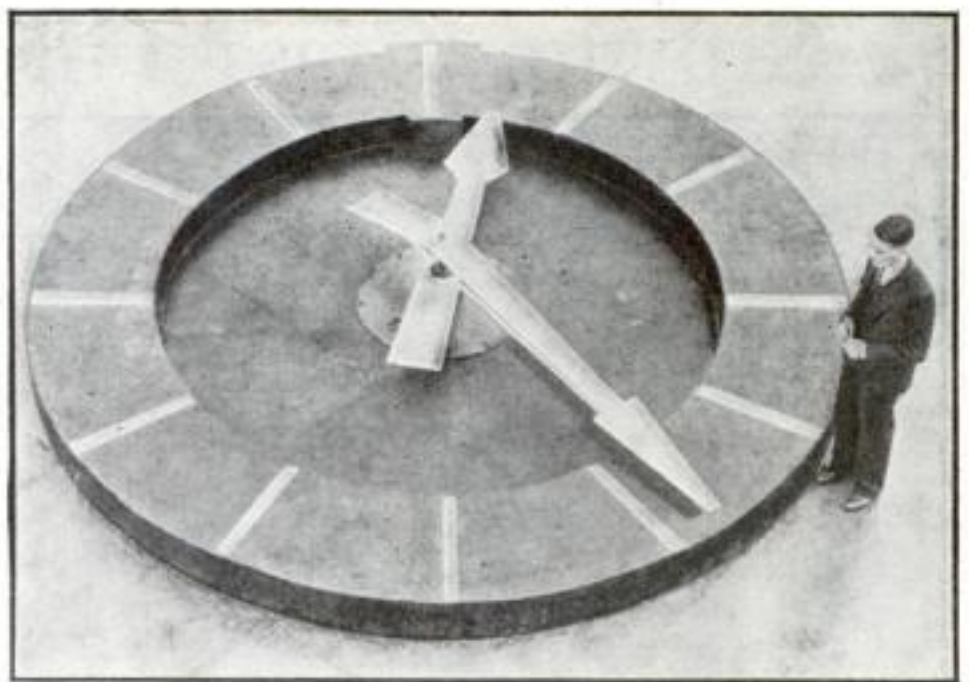
### TWO TYPES OF PLANE BRAKES

Above, air brake for a plane, designed by a California inventor, is mounted on wing struts and unfolds to check plane's speed. Left, Bernt Balchen points to air brake on his Antarctic plane



## BIG CLOCK GUIDES FLYERS

PILOTS of aircraft passing the airport at Heston, England, will know at a glance whether they are ahead of schedule or late. A huge clock, now under construction, will make the correct time plainly visible from the air. So large is its horizontal dial that the minute hand will move nine inches in every sixty seconds. At noon and midnight the hands are to point due north. Knowing this, a flyer can tell the time even when poor visibility obscures the figures. The photograph shows the big clock just before the numbers were painted on the dial.



Plane hovers over speeding auto and through connecting pipe has gas and oil pumped up to it

## FLYING PLANE REFUELS FROM SPEEDING AUTO

TRANSFERRING gasoline from an automobile to a speeding airplane was a feat accomplished at Muroc Dry Lake, Calif., the other day, demonstrating a new way of refueling on the fly. Hitherto an airplane making an endurance flight has been able to take on fuel only from another plane.

For the unusual stunt, a small sedan was fitted with a special superstructure to handle the hose, and contact was successfully made between plane and car after a few minutes' maneuvering. When the fuel tanks had been replenished a supply of oil was pumped to the plane. The success of the stunt depended on keeping the machine at the same speed.

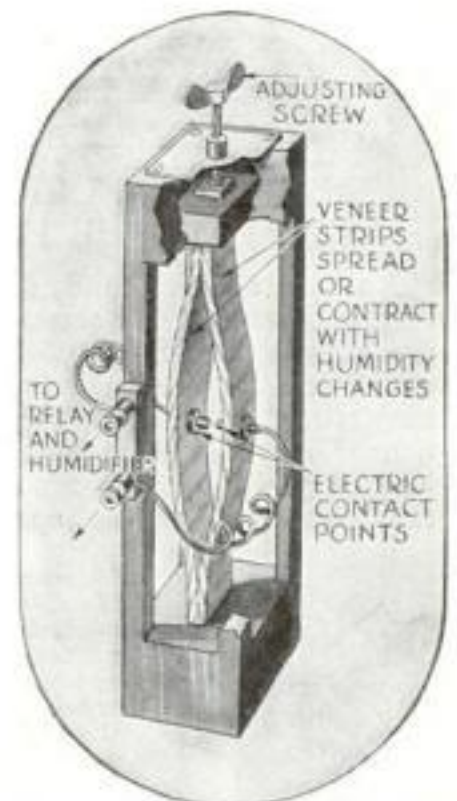
## SUBMARINE LIFEBOAT PASSES HARD TEST

WHEN young Menotti Nanni, Italian-born American, came to **POPULAR SCIENCE MONTHLY** five years ago with a plan to save trapped crews from sunken submarines, he had only a working model of a valve to exhibit. It was to be a part, however, of a submarine lifeboat for which he had already evolved complete plans (*P.S.M.*, Aug. '27, p. 15).

With the successful test of a two-ton model of his invention in New York harbor the other day, Nanni saw his dream near realization. Entering and sealing the torpedo-like chamber of metal, the young inventor was hurled into the sea. The chamber sank from view. After nearly half an hour it bobbed up again and Nanni emerged none the worse for his experience. The test proved, he said, that men aboard a disabled submarine could climb into such chambers, seal the entrance hatch, and float to the surface.



Left, submarine lifeboat bobs up after being immersed half an hour. Above, boat's inventor emerging after the dangerous test



## ELECTRIC SWITCH RUNS HUMIDIFIER

INVENTED to keep moisture constant in lumber-drying kilns, an automatic hydrostat developed at the U. S. Forest Products Laboratory will operate any electric humidifier. The device is a form of electric switch. Two bowed wooden strips shrink in dry air, starting the humidifier, and spread in moist air, shutting it off.

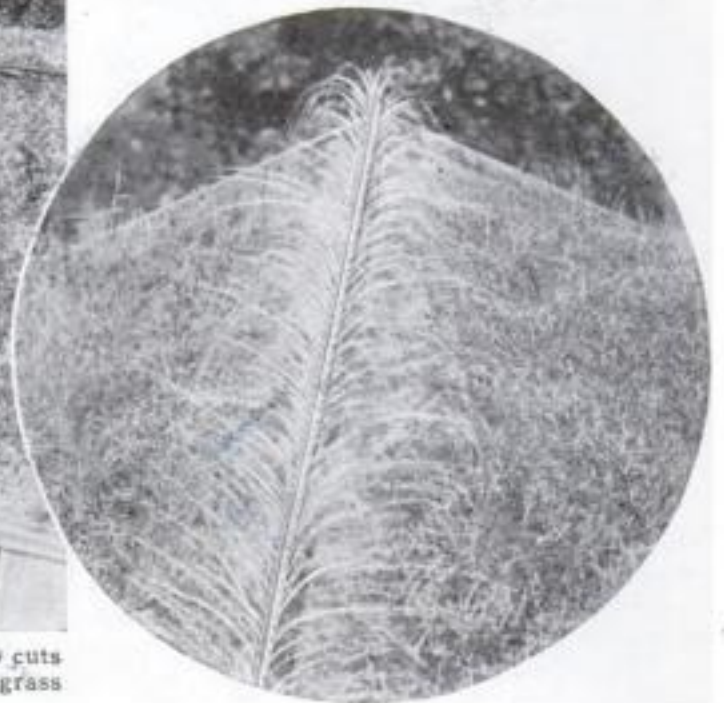


# Growing Grass Turns Roof Into a Lawn



Sod laid on top of tar paper gives this Rockaway, N. Y. home an attractive appearance and also cuts the coal bill. Picture in circle shows how ridge-pole pipes spray water over the roof's growing grass

COVERING a roof with growing grass might seem fantastic to most persons, but Louis Koefoed, an architect of East Rockaway, N. Y., has found it practical as well as decorative. Since he applied a roofing of sod over tar paper to his dwelling last fall he has experienced a welcome decline in his coal consumption. Moreover, he expects the heat-insulating covering to keep his home twenty degrees cooler next summer. Pipes along the peak of the roof spray the growing grass with water and keep the "lawn" roof green.



## FILE HOLDER SHAPED TO FIT THE HAND

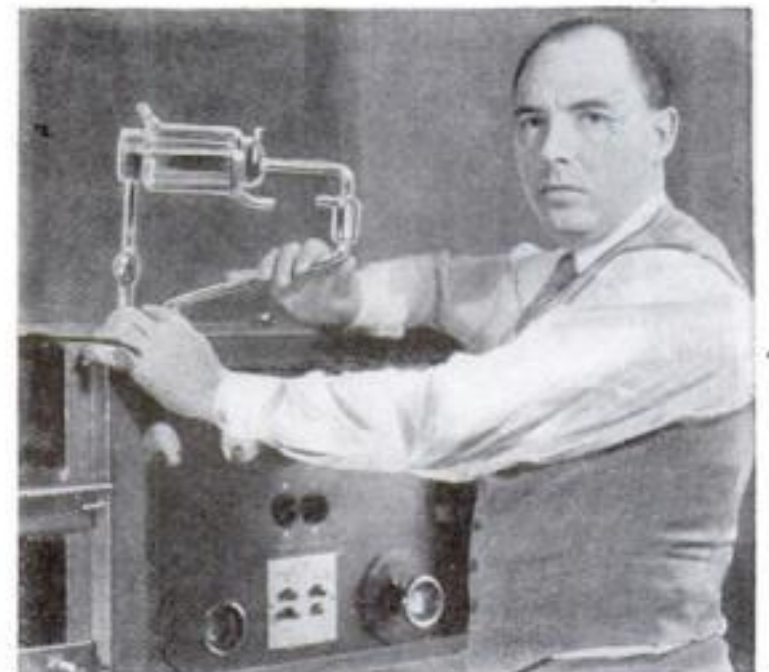
A HANDY addition to the tool kit of any carpenter or home workshop enthusiast is a new detachable file holder. The shape of this handle, resembling that of a hacksaw, is said to eliminate the strain experienced in doing long filing jobs in the usual way. Finger grips are shaped to fit the hand. The handle snaps on any file.

This three-wheeled gage is pushed along over a newly finished highway to detect the hollows and bumps that are in excess of specifications. A buzzer sounds when road is not smooth



## COLD LIGHT BULB AIDS TELEVISION

EFFICIENCY twenty times as great as that of an ordinary incandescent bulb is claimed for a lamp demonstrated the other day in a New York laboratory. Since it turns into useful light an unusually high proportion of the current it consumes, instead of wasting it in heat, the bulb is so cool it may safely be used in motion picture projectors. Another application foreseen is the projection of television images on a full-sized theater screen. The lamp contains mercury, that glows through electrical induction when the tube is placed within a coil of copper tubing carrying a high-frequency current.



Mercury in this lamp furnishes cold light when the tube is placed within a coil carrying high-frequency current

## ROAD GAGE REVEALS UNEVEN PLACES

ONLOOKERS probably would be mystified to see a man trundling a three-wheeled contrivance of metal, like the one illustrated at the left, along a freshly-laid highway—especially if they chanced to be near enough to hear an occasional "buzz-buzz" from the odd instrument. Actually the tool affords a speedy way of checking up on a new road to make sure that it conforms to specifications. When this "bump detector," as it rolls along, encounters high or low spots beyond the limits of tolerance, an electric circuit is automatically closed and the buzzer sounds. The device is easily portable and may be folded for convenient handling.



# Garden Fish Ponds Made of Rubber



A RUBBER fish pond, said to be more durable than concrete, has been put on the market by an Ohio inventor. It consists of a metal frame supporting a basin or tank of sheet rubber with a layer of copper screen-wire embedded in it for added strength. In installing the rubber pool, the iron-pipe rim of the tank is laid on the ground and twenty-inch iron stakes

driven at intervals around it. These stakes act as guides in digging the pond to the standard depth of about twenty inches. After dirt is tamped around them, they become supporting posts for the tank edge. The sheet-rubber lining is attached to the iron-pipe rim by cementing and sewing before the tank is set down in the ground.

Below, adjusting the iron supports of a rubber fish pond. At left, the pond as it appears when sunk in garden and ready for use

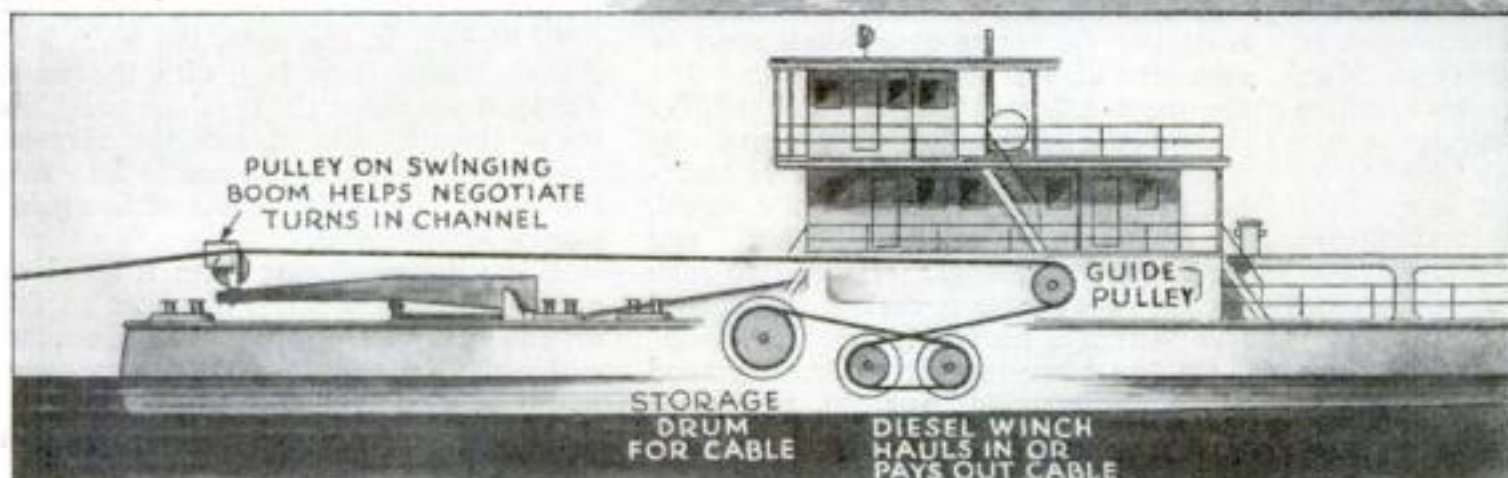
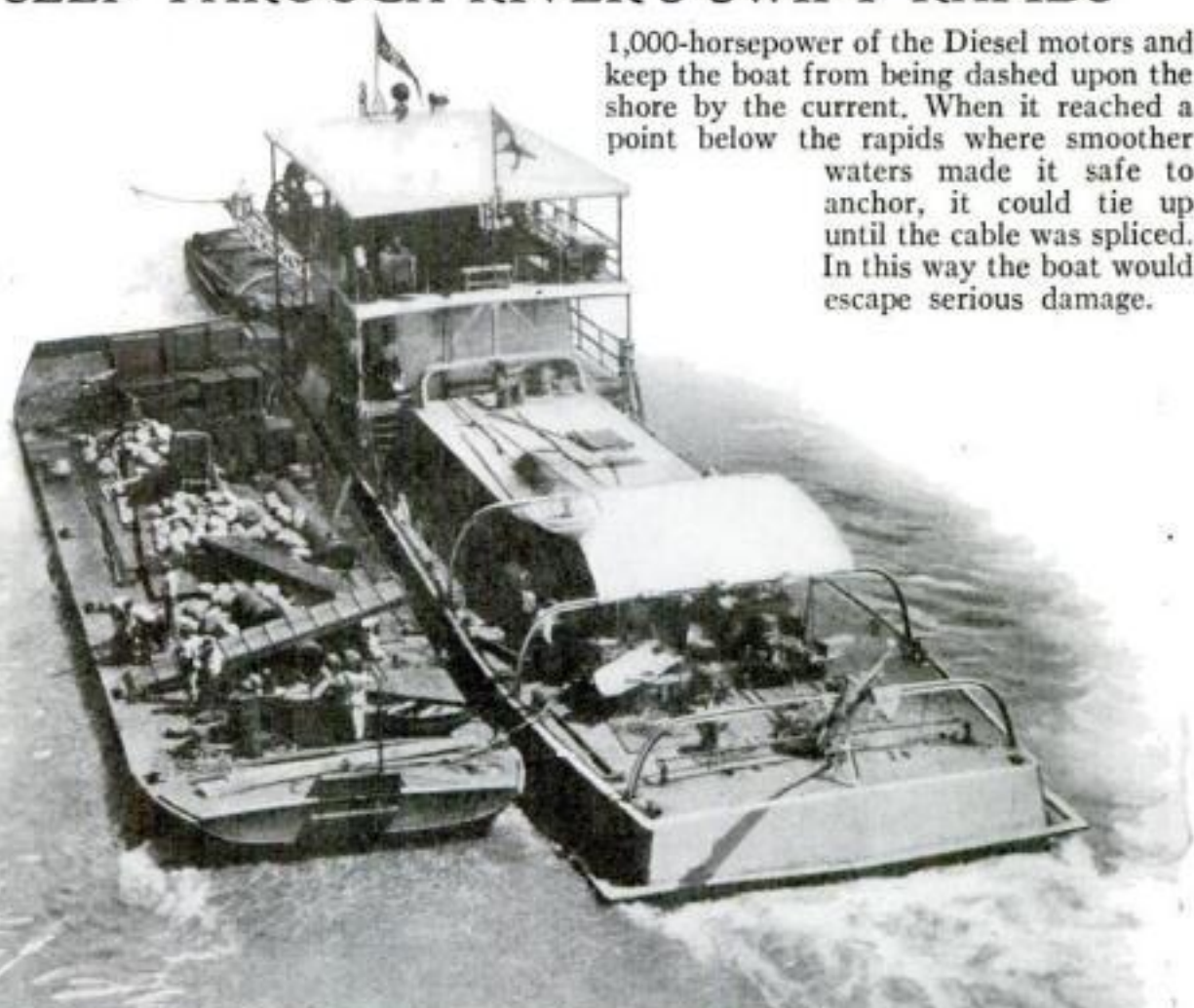


## TUGBOAT HAULS ITSELF THROUGH RIVER'S SWIFT RAPIDS

A TUGBOAT that hauls itself upstream on a cable is used on one of South America's strangest water routes—a mile-and-a-half stretch through treacherous rapids of the Magdalena River, in Colombia. Previously all cargoes had to be trans-shipped by rail past this point, which was the only unnavigable section of the river for 500 miles. Now the odd Diesel-powered tugboat carries loaded barges straight through.

Designed especially for its unusual task, the tugboat, when it maneuvers alone, is driven by four propellers. Additional traction is needed to ascend the rapids with a toload, however, and for this reason a 7,200-foot cable was laid along the course of the river and anchored at the upstream end. A motor winch on the tug winds up this cable, enabling the craft to haul itself slowly up the rapids, propellers churning meanwhile. On the return trip downstream, the winch pays out the cable. A pulley on a swinging boom helps negotiate turns. If the cable should break, an emergency control would automatically unleash the reserve

1,000-horsepower of the Diesel motors and keep the boat from being dashed upon the shore by the current. When it reached a point below the rapids where smoother waters made it safe to anchor, it could tie up until the cable was spliced. In this way the boat would escape serious damage.

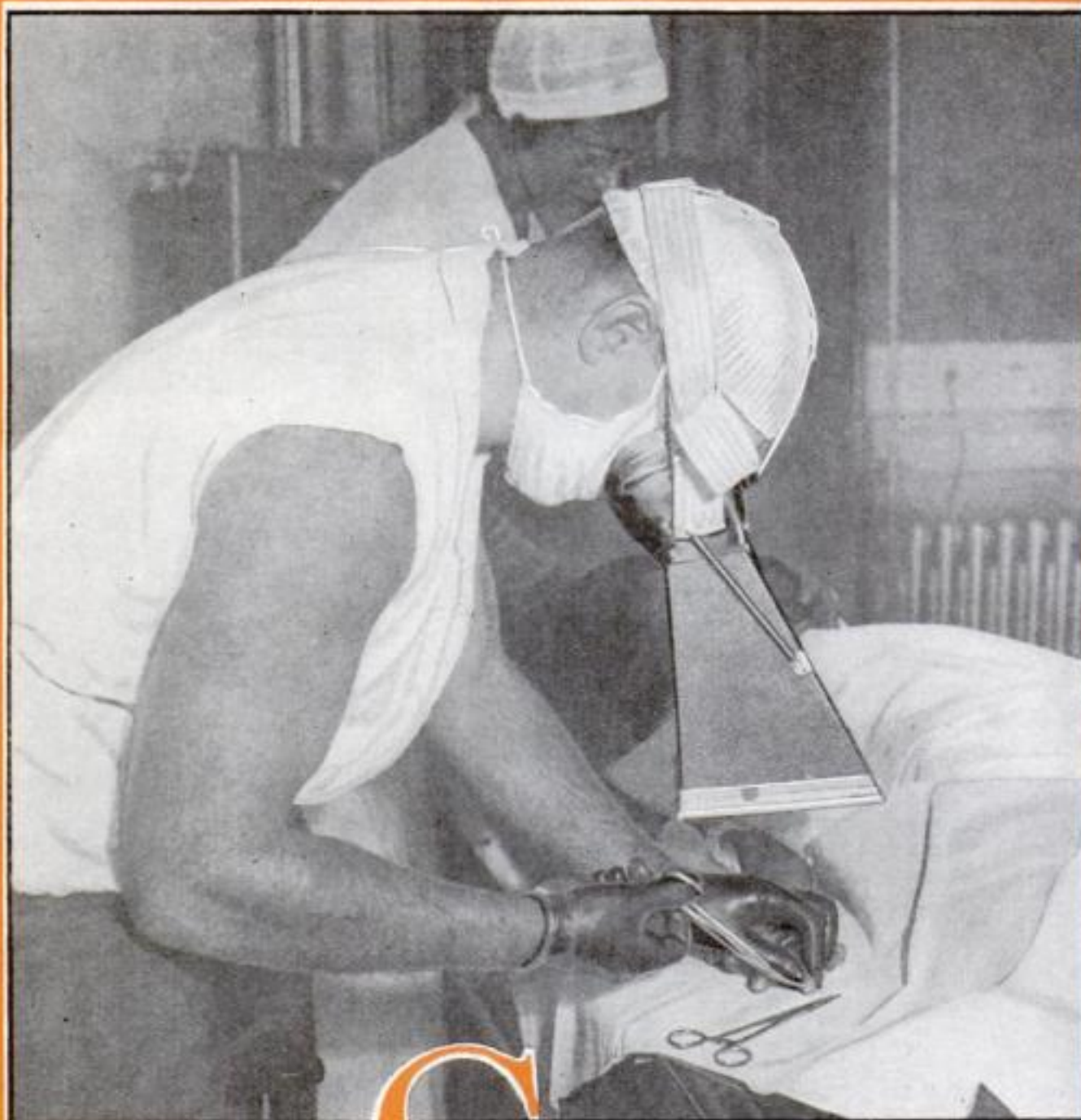


Tugboat, above, running the treacherous rapids of a South American river using its own power to make the ascent. At left, drawing shows how cable is wound in by a Diesel winch as boat advances



By  
FREDERIC  
DAMRAU,  
M.D.

Life-saving adventures more thrilling than those found in any novel are described in this article which continues the remarkable story of modern surgery. At right, noted surgeon wearing his fluoroscope during an operation



How

# Modern Surgeons Conquer Fatal Germs

A SMALL item recently appeared in the newspapers. It reported a new ruling of the American College of Surgeons. In the future, all surgical thread must be tested thirteen days instead of six to insure its freedom from germs. That tiny item was buried in the back pages of the papers. Few people read it. Yet, behind it lies one of the most thrilling chapters in the whole dramatic story of death-fighting by surgery.

Less than seventy years ago, such a simple operation as the amputation of a finger was a life and death matter. In one famous European hospital, eleven out of seventeen amputations resulted in death from blood poison. Germs of infection were unsuspected. Sterilization, as we know it today, was unknown. Antiseptics were undreamed of. Doctors knew little about infection and were helpless before it.

It was not until after the Civil War, that antiseptics first appeared and revolutionized the science of surgery.

Before then, only a few kinds of operations were ever attempted. The odds against the patient were heavy and the work of the most skillful surgeon was

often undone by swarming germs. Today, with this menace of microbes in the operating room conquered, several thousand kinds of operations are commonly performed and almost daily new feats, that read like astounding fiction, are added to the case-books of famous surgeons.

Witness, for example, this instance coming from Chicago, Ill.

A fifty-six-year-old man was suffering from the dangerous condition known as aneurism of the aorta. This means that the main artery, through which all the blood of the body flows, had become flabby and distended. With every pounding heartbeat, the weakened walls bulged outward. At any moment, they might burst and death result. It was as though the man walked about with a cocked and loaded gun pointed at his heart.

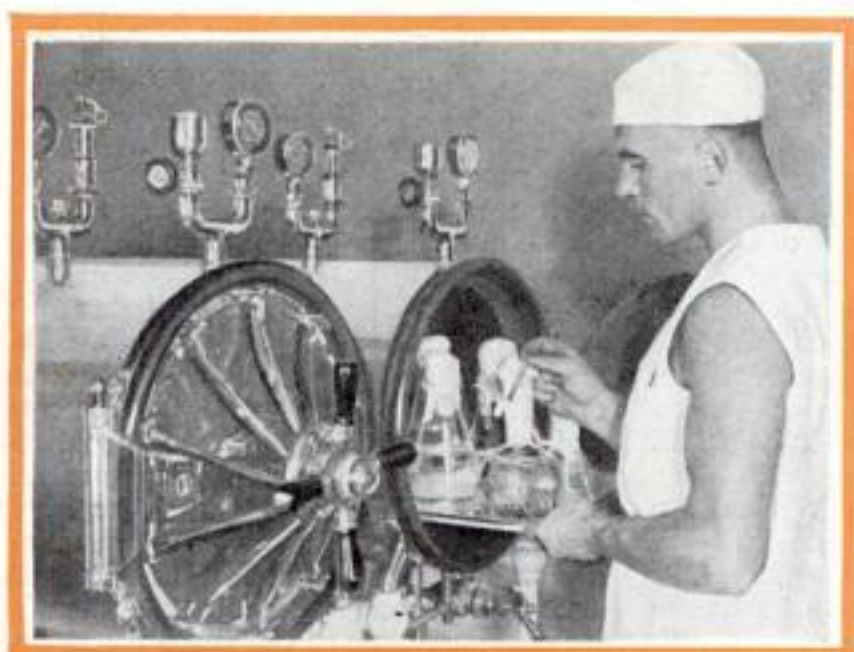
On the operating table, Dr. Raymond W. McNealy, noted surgeon, performed a daring experiment that saved his life. Cutting a long incision near the heart, he

reached the aorta. Then, around this artery he wrapped *seventy feet* of special gold and platinum wire, about the same diameter as number twenty-nine piano wire, strengthening the walls and holding them in place. Today, with blood pumped to his body through this wire artery, the man is in excellent health!

Some years ago, I witnessed another marvelous operation for the same mysterious disease. In this case, the aorta had dilated into a large bag with the walls stretched almost to the breaking point. In the operating room, I saw the surgeon push a hollow, insulated needle into this bag and then pass thirty feet of fine gold-platinum wire inside.

This wire, unwinding from a spool of approximately the same diameter as the distended aorta, curved around and around within the walls of the cavity. As soon as it was in place, the surgeon attached the outside wire to the positive pole of a battery and placed an electrode from the





A seemingly unimportant event, occurring about the time Grant met Lee at Appomattox, began the transformation that changed such conditions into those of the present. A young surgeon in Edinburgh, Scotland, read a pamphlet entitled: "The Decomposition of Inorganic Fluids." The pamphlet was by Louis Pasteur. The young surgeon was Joseph Lister, now world famous.

For months, Lister had been spending his spare time peering through microscopes at the feet of frogs and the wings of bats. He was trying to find out exactly what happens in the thin sheets of membrane

Later, he designed a three-legged pump with a long handle, worked by an assistant, which shot clouds of carbolic acid spray over both surgeon and patient during an operation. The spray affected the stomach and choked up the lungs. It numbed and whitened the hands of the surgeon and got in the eyes of the patient. But, in its crude way, it killed germs and saved lives. This wheezing pump of Lister's, dubbed "The Donkey Engine," started surgery on its road to the wonders of today's operating rooms.

His was the "antiseptic method." It concentrated on killing the germs in the wound during the operation. Modern hospital technique has taken another step forward. It employs the "aseptic method." This concentrates on preventing germs from ever reaching the operating table.

The infinite pains required to make it a success can best be illustrated by taking you behind the scenes and letting you watch, step by step, the precautions taken before, during, and after an operation.

Incidentally, this backstage glimpse will answer some of the common questions people ask me, such as: Why do surgeons wear masks over their faces? What is the longest time an operation ever takes? What would happen if a surgeon died in the middle of an operation? Is everything quiet in the operating room or does conversation go on? The work of protecting the patient from infection begins the

#### KEEPING THE GERMS AWAY

Devices containing chemicals that change color when subjected to heat sufficient to kill germs are used to check the sterilizing apparatus and thus insure germ-free instruments and dressings. At top, the attendant is holding a glass tube control device and above is one of cardboard on which there is changeable ink

negative pole under the patient's back. For three-quarters of an hour, the current passed through the wire in the artery. Then, the surgeon removed the electrode and snipped off the wire, leaving the thirty feet within the aorta. The effect of the current passing through the bloodstream had been to form clots around the wires inside the walls. These clots later hardened into permanent form, resembling scar tissue. This added to the thickness and strength of the walls, thus prolonging the life of the ailing man.

Whenever wires are used in operating rooms, they are always sterilized by boiling them in water or by passing them through naked flames. Nothing enters the swinging doors of such a chamber without a searching inspection. Every bandage, every instrument, every gown is carefully sterilized. By rigorous regulations and unceasing vigilance, the patient is protected from infection in the modern hospital.

Contrast with this the conditions eighty years ago. Common sponges were used to wash out wounds and the same sponge was used on several patients, the physician merely squeezing it out in water between times. Instead of white robes, surgeons wore "operating coats," the dirtier the better, as soiled and bloodstained garments were thought to be an indication of the wearer's wide experience. The nearest approach to protection against germs was a small canopy of linen sometimes erected over a wound to keep out dust.

The manner in which bandages, gauze, and instruments are arranged for an operation is shown above. The nurse is demonstrating manner of passing instruments to surgeon. At right, pedals control water so nurse does not touch the faucet while washing her hands

when inflammation sets in. For eleven years, he had been searching for a method of making wounds heal perfectly. Then, in a flash, Pasteur's pamphlet, reporting the discovery that bacteria cause decomposition, suggested the solution. Invisible microbes cause infections! This "germ theory of infection" forms one of the really great discoveries of all time.

Lister's first step in combating microbes was the development of a "carbolic acid putty" for sterilizing wounds.



Photos by  
HALBRAN  
at Long Island  
College Hospital  
and Crown Heights  
Hospital





night before the operation. The spot where the incision is to be made is washed off with hot water and tincture of green soap. Then all hair is carefully shaved away, the spot is again washed with alcohol, and finally covered with a sterile towel. The next morning, alcohol is again applied, then ether, to dry the skin, and lastly iodine, or in cases where the skin is tender and will be burned by iodine, a combination of picric acid and alcohol.

Clad in a sleeveless flannel chest protector, or "ether jacket," and long woollen stockings, the patient is wheeled into the chamber where the anesthetic is administered. This is usually a small room connecting with the main operating room. All jewelry has been removed. Even wedding rings cannot be worn into the operating room. When patients object to this rule, the rings are sometimes sterilized and secured to their wrists.

In an adjoining room, the surgical team is getting scrubbed up for the operation. Hands and arms, to a height of two inches above the elbows, are washed for ten minutes with hot water and tincture of green soap. Washstands are equipped with foot or knee levers for regulating the flow of water so the hands never touch faucets. Sterilized white gowns of lawn or muslin are then slipped on and caps are pulled into place covering all the hair. Masks of gauze, five or six layers thick, cover the mouth and nose to prevent the breathing of a nurse or surgeon from carrying germs into a wound. Every member of the team must be in good health and free from colds.

Extra-strong sterilized rubber gloves cover the hands. They have been soaked in a five percent carbolic acid solution for two hours and then powdered. Each glove is blown up and tested for leaks before it is used. Even a pin-prick cannot be disregarded. Germs from the hands might work their way through it into the wound, for, no matter how long they are scrubbed, hands never become surgically clean. Again, virulent pus from a ruptured appendix or other infection might find its way into the faulty glove and endanger the life of the surgeon.

**I** REMEMBER one dramatic moment of the sort in an eastern operating room. The famous surgeon, Algernon Bristow, was performing an emergency operation on a patient with a ruptured appendix. As he removed his scalpel, dripping with pus, the razor-sharp edge flicked across a fingertip, slitting the glove and the skin beneath. The operation was at a critical point. He dare not stop even long enough to change his glove, for the primal law of the operating room is: The Patient Comes First. He realized his danger, but we saw him tighten his lips and go on. By the time he had finished his work and sterilized the cut, the germs had entered his bloodstream. That was the last operation he ever performed. A week later he was dead.

Nothing in the operating room is touched by any one except those who are scrubbed up, that is, completely

sterilized. An unbroken aseptic chain must be maintained in handling every object. If an instrument drops to the floor during an operation, it must be reboiled the full twenty minutes, except in extreme emergencies when it is sterilized by passing it several times through the flame of burning alcohol. Between operations, and often between two parts of an operation on the same person, everything in the room is either changed or sterilized. Gowns, gloves, instruments, and utensils are all shifted as an added precaution against infection.

**T**HE members of a surgical team are drilled like soldiers. Wartime discipline rules in the operating room. No one speaks except the surgeon and the anesthetic ex-

pert who reports on the breathing and pulse of the patient. Every operation is a race against time, some lasting more than three hours, so there must be no confusion, no waste motion. Each member of the team has a definite duty to perform.

One nurse is responsible for the proper placing of the patient on the operating table and the adjustment of the lights over it. Another does nothing but remove lids from basins, place buckets and fill pitchers. The suture nurse hands instruments and sewing materials to the surgeon, always holding in reserve a duplicate of the instrument he is using so in an emergency, it can be replaced without an instant's delay. Another member of the team is detailed to check the sponge count, making sure none of the gauze pieces are sewed up inside the wound.

A fifth nurse presides over the autoclave, the polished metal cylinder in which gauze, bandages, and towels are sterilized by steam under pressure. Increasing the pressure in the chamber raises the boiling point of the water. At twenty pounds pressure, for instance, water, which ordinarily boils at 212 degrees F., requires 260 degrees, thus increasing the heat to which the microbes are subjected.

The work of the autoclave nurse is of key importance. I recall the terror that seized us, some years ago, when three successive cases leaving our operating room developed infection. We appealed to a bacteriologist. Like a detective, he traced the microbes to their source. Gauze dressings, applied to the wound after the operation, had not been sterile. A nurse in charge of the autoclave had hurried them through the sterilizing process, saving a few minutes at tremendous expense.

**N**OWADAYS, to insure every bandage is completely sterile, changeable ink is placed in the chamber. It alters its color only when it has been left in the autoclave long enough to kill all possible germs of infection. Diack controls, small glass tubes containing a substance which also changes color with adequate sterilization, are similarly used. In addition, cultures of live germs are sterilized in the autoclave once a month and then examined in the laboratory to make sure all microbes are being killed.

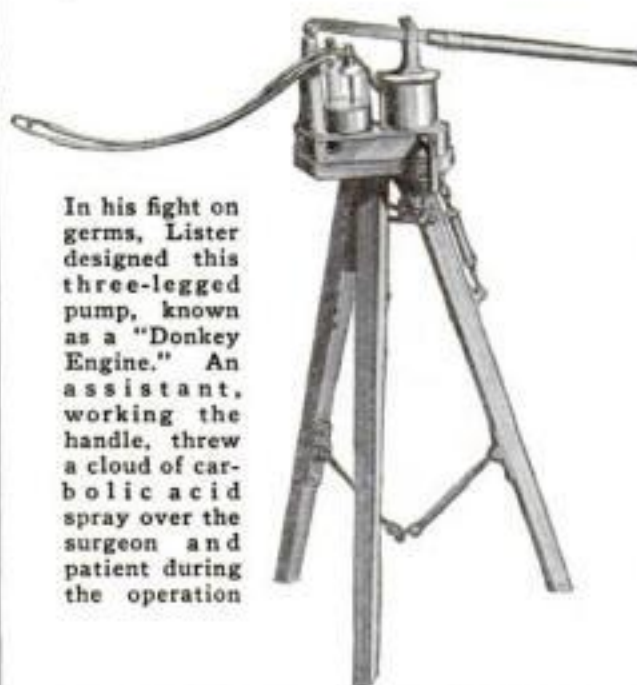
Overseeing the work of the team is a head nurse who gives the final O. K. to the sponge count and is prepared to assist at any post during an operation. One of her duties is wiping the face and brow of the surgeon. A single bead of perspiration falling into an open wound would carry germs inside and undo all the precautions that have been taken. The temperature in operating rooms is automatically kept at between seventy-eight and eighty degrees F. To absorb perspiration and protect patients, many surgeons place pads of folded gauze over their foreheads under their sterilized caps.

Standing beside the surgeon, during every serious operation, is a second surgeon, ready to assist him or take up the work at any point in an emergency. *(Continued on page 94)*



## JOSEPH LISTER First to Use Antiseptics

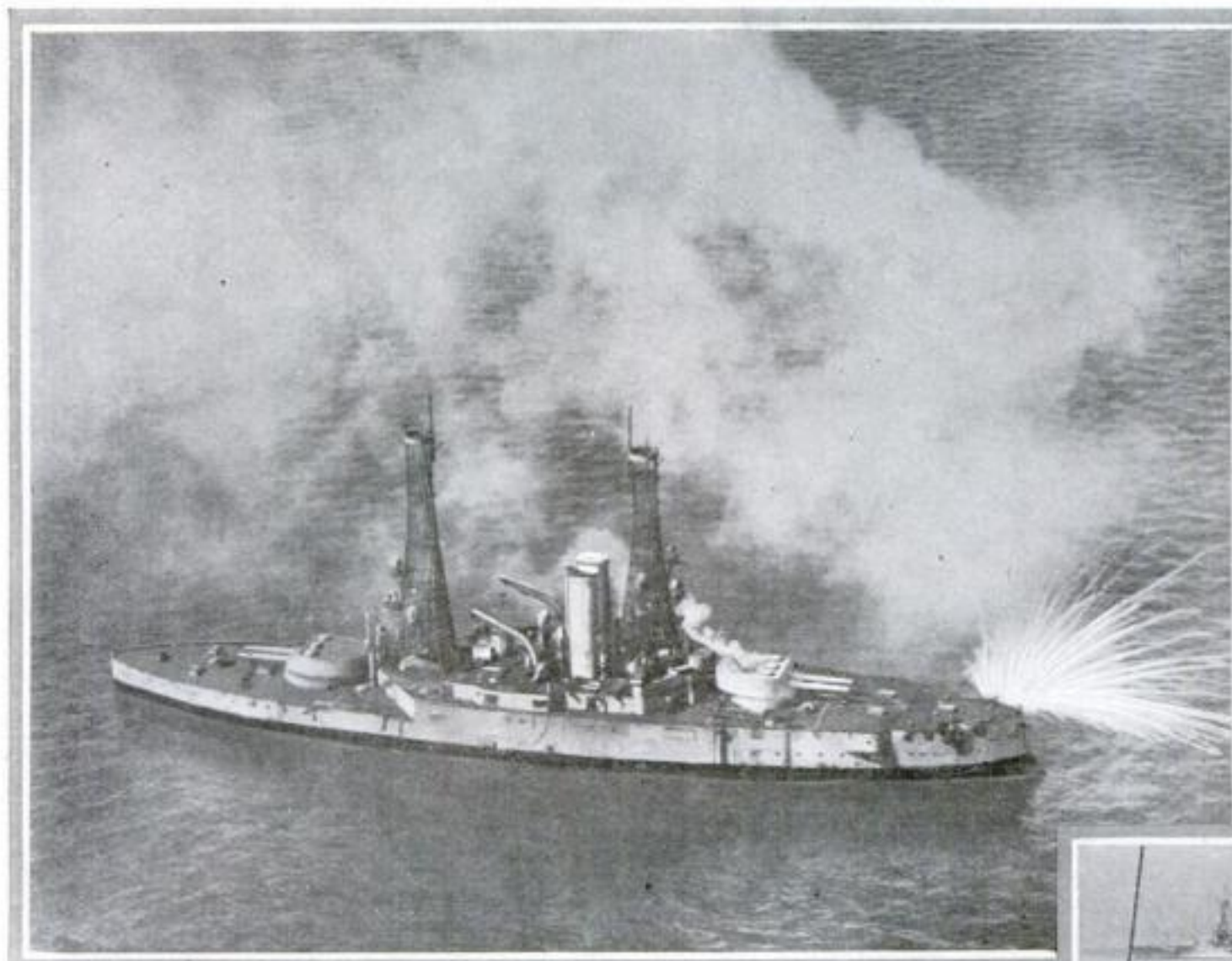
Seventy years ago, even trifling operations were highly dangerous. It was not until Joseph Lister, noted English surgeon, developed his germ theory of infection that surgery came into its own. As a result of his crude efforts, sterilization now keeps all germs out of the modern operating rooms.



In his fight on germs, Lister designed this three-legged pump, known as a "Donkey Engine." An assistant, working the handle, threw a cloud of carbolic acid spray over the surgeon and patient during the operation.



# Ghost Ship Bombed by Navy Planes



**F**IVE direct hits out of thirty bombs dropped was the score unofficially reported when Navy planes attacked the radio-controlled battleship, *Utah*, off the California coast the other day. They used duds filled with water to avoid damaging the radio wonder. Obsolete as a war craft but prized as a target ship, the *Utah* is the latest and largest of several vessels that the Navy has equipped to run without a man aboard. A mile away, it starts, turns, and stops under radio control from the mine-sweeper *Robin*. The striking picture at the left, taken during the recent air attack shows a bomb just missing the ghost battleship.



## SETTING THE *UTAH* ADRIFT

Above sailors leaving the radio controlled *Utah* before air attack starts. Right, ship's mascot is being lowered to the boat



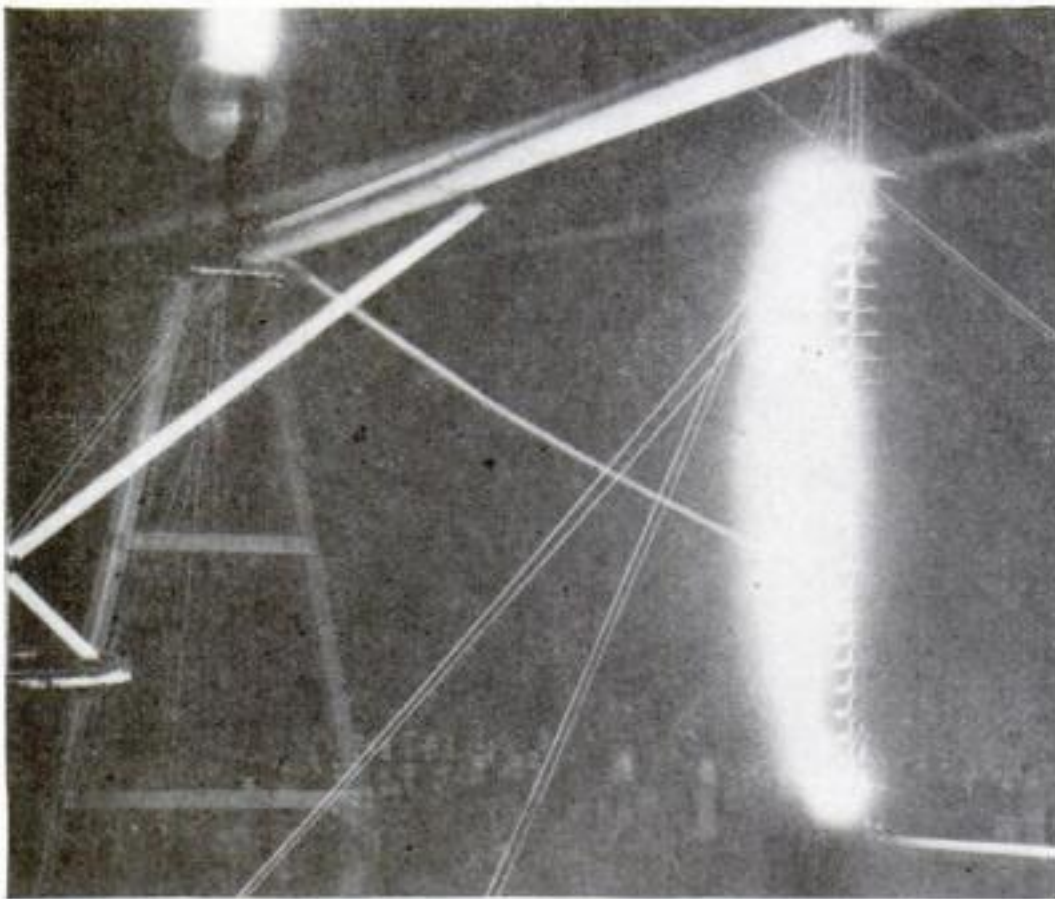
## GUIDING GHOST SHIP

In the background, right, is the radio controlled *Utah* which is directed by an officer aboard the *Robin*. Below, moving the keys in *Robin*'s control room, that steer distant ship

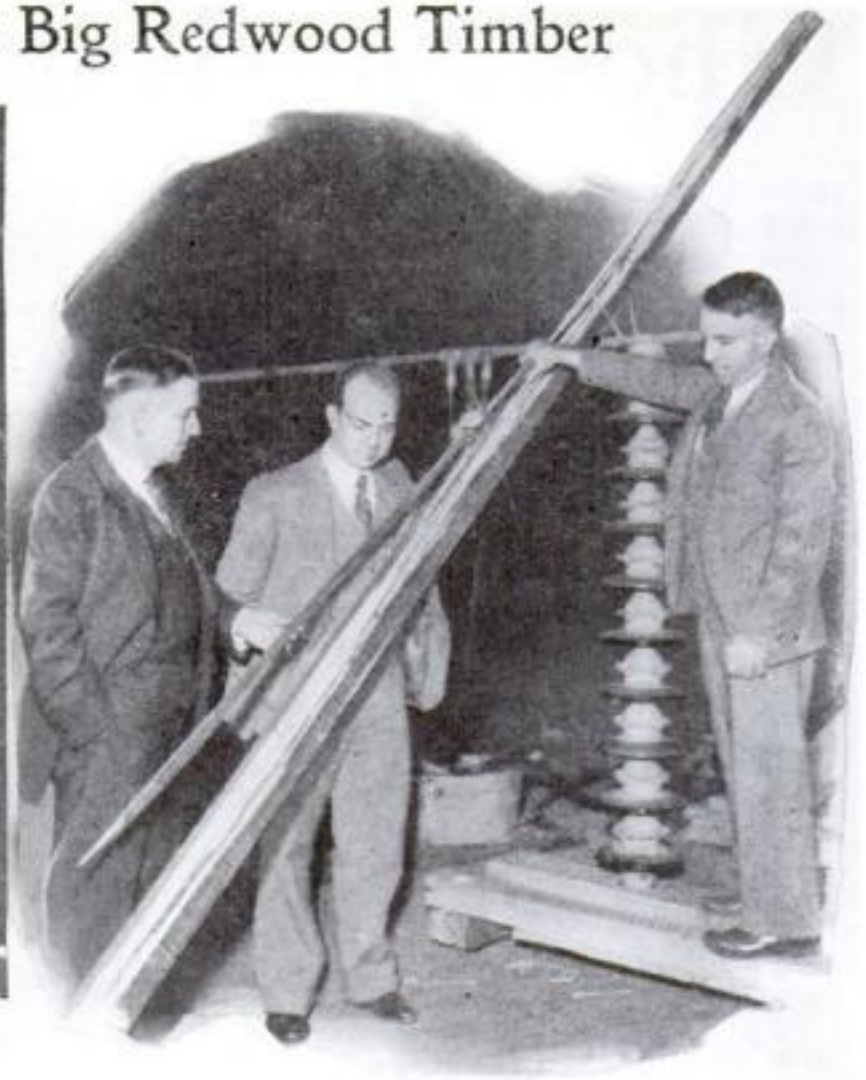




## Man-Made Lightning Shatters Big Redwood Timber



Above, 3,000,000-volt lightning flash made in laboratory tearing its way through an eighteen-foot redwood timber in a spectacular demonstration of a new machine. At right, experts examine timber shattered by the lightning



MAN-MADE lightning of 3,000,000 volts shattered an eighteen-foot, four-by-four timber of redwood in a spectacular demonstration of a new high-voltage machine

at Stanford University the other day. The apparatus operates on the principle of a Leyden jar, storing up electricity in a huge condenser and then liberating it all at once

in a blinding discharge. It will be used to find the best type of insulators for the high-voltage transmission lines from Boulder Dam to Los Angeles, Calif.

## STEEL GRID IN ROAD ENDS SKIDDING

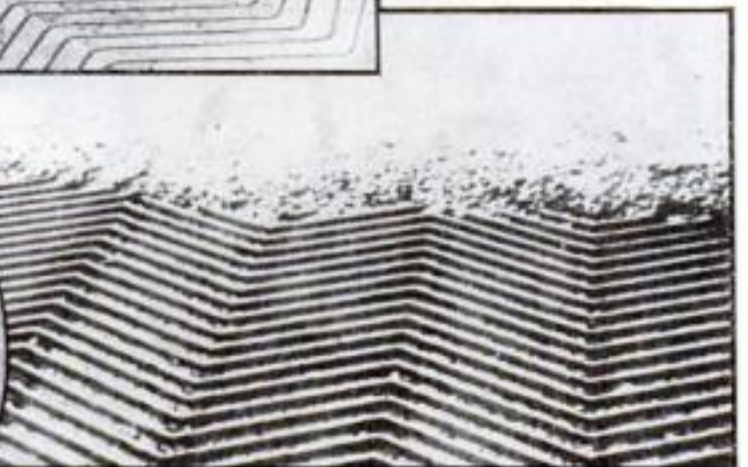
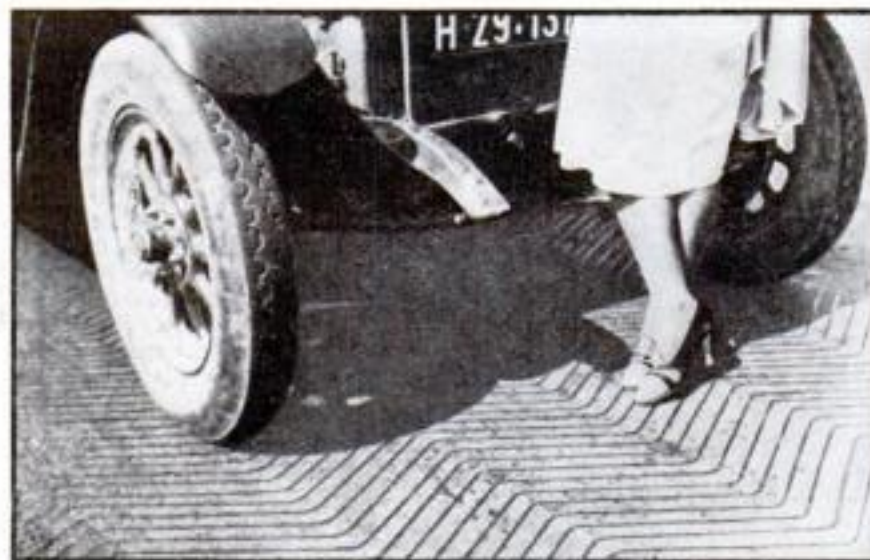
ZIG-ZAG metal frameworks that suggest grids for roasting meat are being used in Austria to produce highways with non-skid surfaces. After the road has been leveled, the steel roasting grid is placed on top and gravel is pounded into the spaces

between the bars. These zig-zag lines of steel, protruding slightly above the gravel, give the surface of the road a tread that prevents skidding. At the same time, it is said, they lengthen the life of the highway and prevent the formation of ruts or washboard depressions in the gravel. One of these unique roads, built by the Austrian Experimental Society has been in use for more than a year and has proved highly satisfactory in preventing skidding and maintaining its surface in spite of the wear of heavy trucks and severe weather.



## WINDOW CLEANING BRUSH IS WHIRLED BY MOTOR

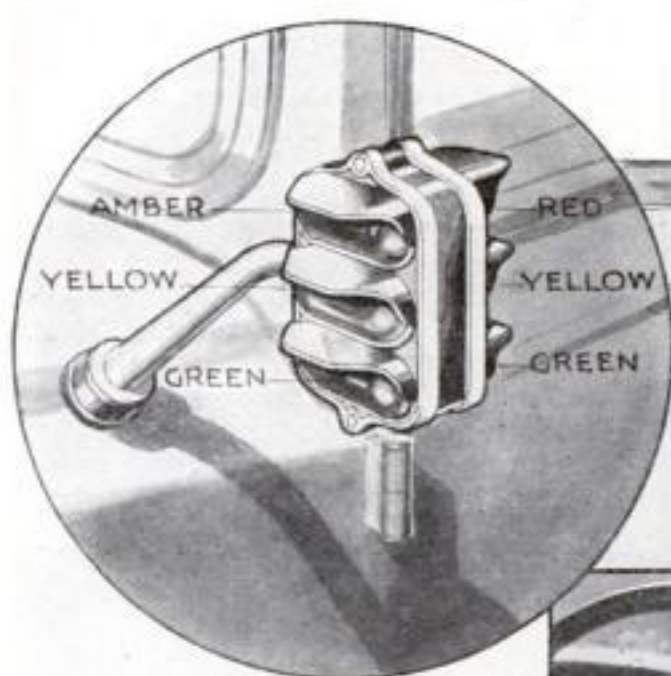
EVEN the task of the window washer is now made easier by labor-saving machinery. An electric window cleaner devised in England assures a thorough and a fast job. Its revolving brush of felt, mounted on a convenient pole, is spun at high speed by an electric motor. As shown in the photograph above, the device is sufficiently light to be handled with facility.



Zig-zag grid of steel laid in Austrian highway to prevent cars from skidding. At top is a section of the finished road and above is uncompleted portion. At left, workman locking the bars of steel into place in the roadway



## Traffic Lights on Auto Signal Right or Left Turning



Traffic light attached to side of car to signal right and left turns and stop



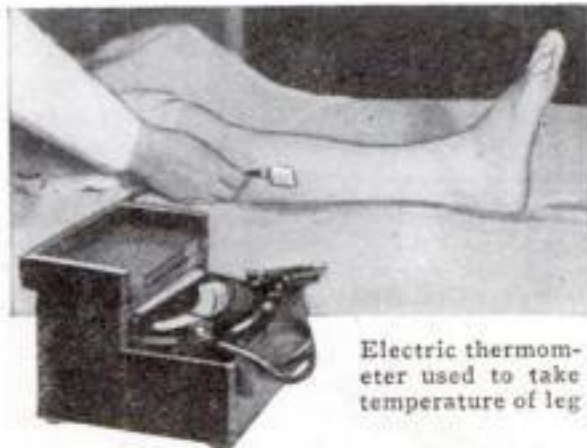
Left, photo of dashboard with switch that controls car's traffic lights. At right and above, drawings show how lights work and colors used

Left	Right
YELLOW	YELLOW
CAUTION	
GREEN	RED
RIGHT TURN	
RED	GREEN
LEFT TURN	
GREEN	GREEN
STRAIGHT AHEAD	

WILL miniature traffic lights for each car banish hand signals, and make driving safer in crowded city streets? Police officials of Oxford, England, recently saw such a system demonstrated by Sir William Morris, motor car maker. Installed in pairs one on each side of a car, and operated from a dashboard switch, the new lights use stop and go signals familiar to every motorist to warn of turns and other maneuvers. To signal a left turn, the lights first show yellow on both sides—a caution signal. Then they change

automatically to red at left and green at right. The reverse of these signals is used in turning right or in pulling over to the right-hand curb to park. An all-green signal, straight on, indicates the driver will not turn at an important intersection. Signals are visible from front and rear,

the front of the red light being shaded to amber because motor laws forbid a red light facing ahead. An automatic timer in the control switch makes each signal flash several times and then puts the light out without any further attention from the driver.



Electric thermometer used to take temperature of leg

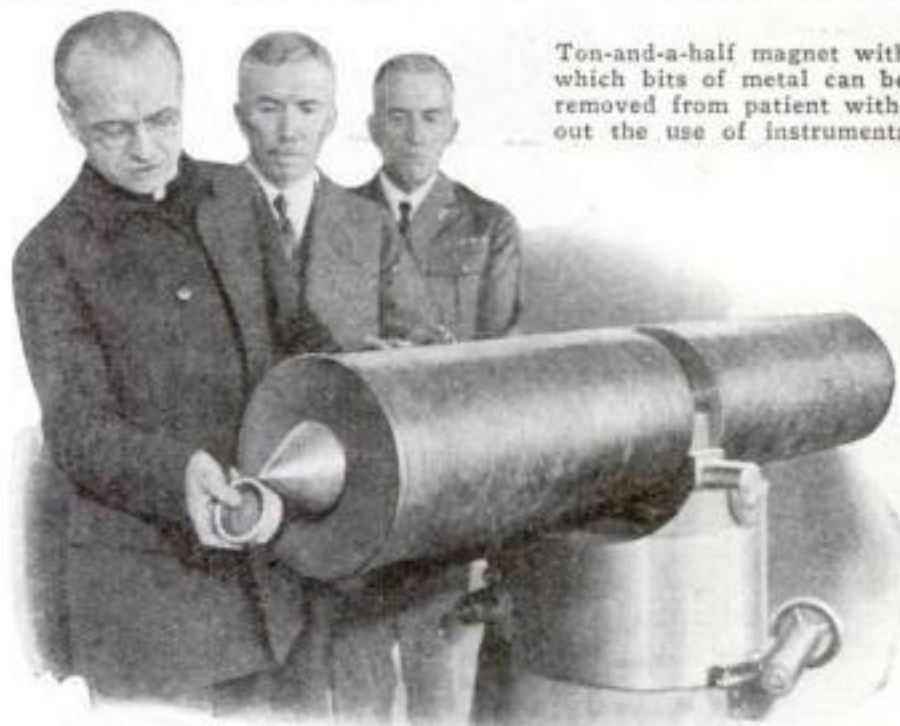
### ELECTRIC PAD SHOWS BODY TEMPERATURE

A CLINICAL thermometer held in your mouth, if you are healthy, will give a reading of ninety-eight and six-tenths degrees. That does not mean that your entire body is at the same temperature as it may vary at points on the surface.

Physicians must often know such temperatures with precision, and a new instrument designed to help them was demonstrated a few days ago by engineers of the General Electric Company. Known as an "electric resistance thermometer," this instrument comprises a detector pad about an inch square, an electric meter dial, and a plug for connection to the usual 110-volt house current supply. When the detector pad is placed upon the patient's body, the electric dial indicates the temperature to within less than half a degree F. The meter is actuated, in response to body warmth, by the altered electrical resistance of many turns of fine, insulated copper wire on the detector.

## MAGNET HELPS DOCTOR EXTRACT METAL

FOREIGN bits of metal may be removed from the throat, chest, or abdomen of patients with a minimum of laceration, surgeons predict, with a ton-and-a-half magnet just completed for the St. Louis University Medical School. A fifty-horsepower dynamo furnishes electric current for the giant magnet, which, without difficulty, can lift a metal operating table from the floor. It has been used to extract metal from patients' eyes.



Ton-and-a-half magnet with which bits of metal can be removed from patient without the use of instruments

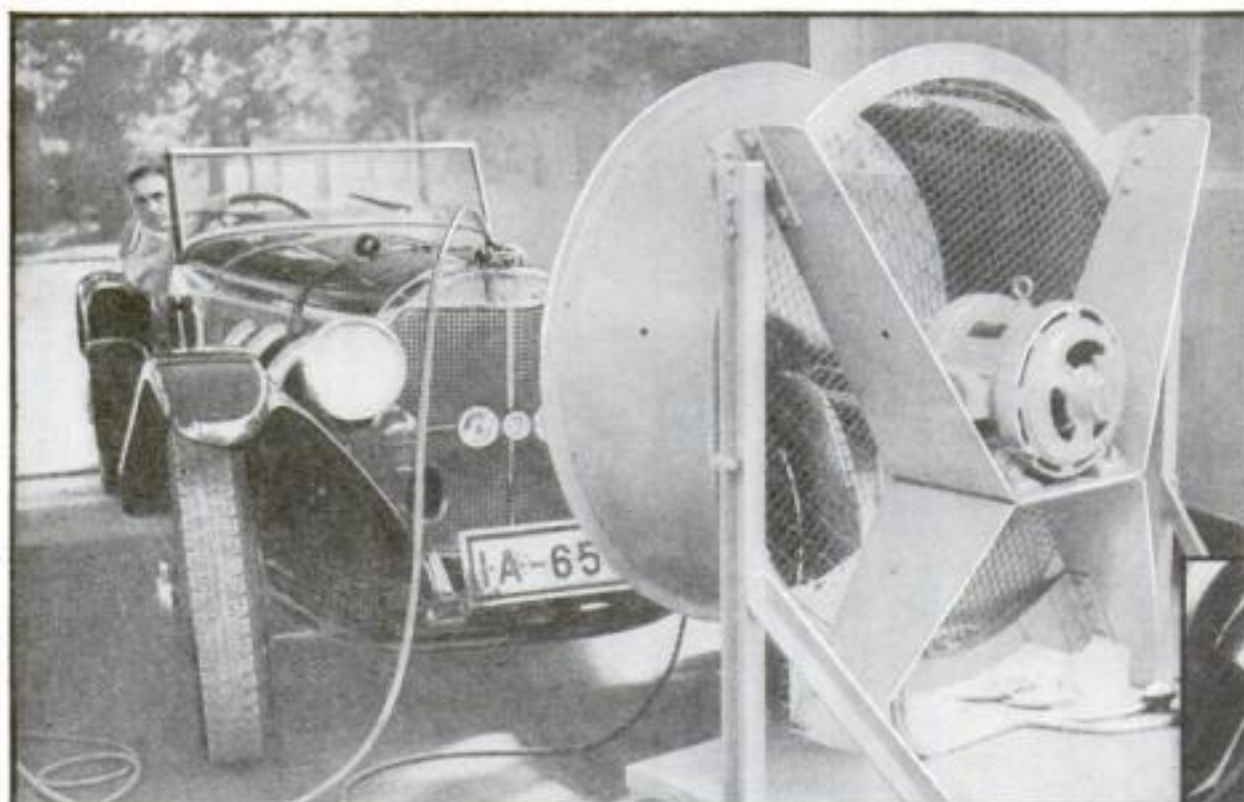
## WEAPON FOR MOTORISTS BRANDS THUG WITH DYE



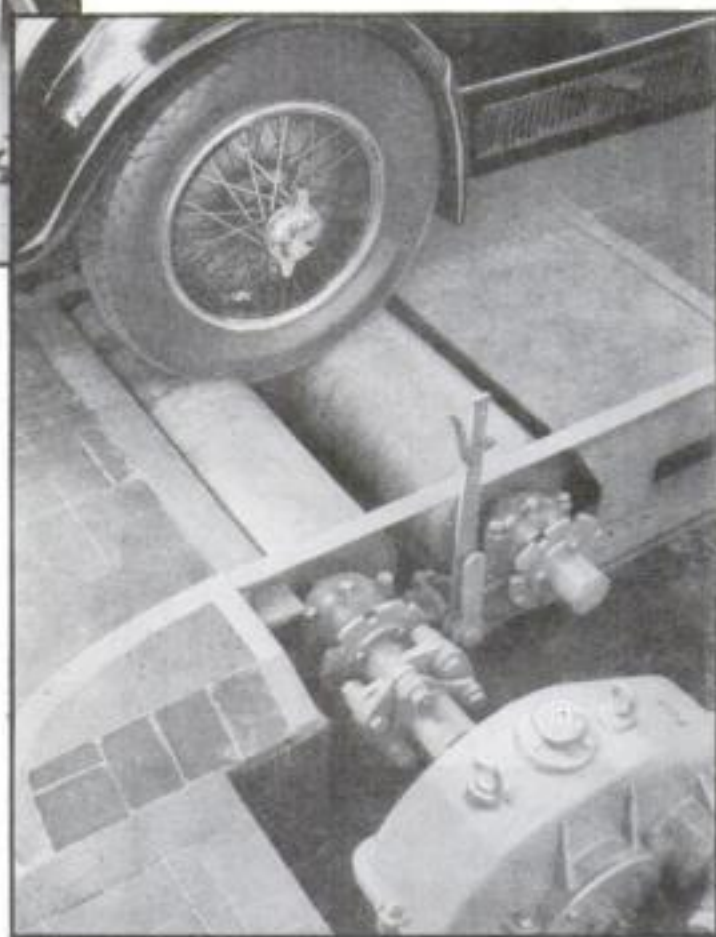
A NEW weapon for the protection of motorists and shopkeepers not only subdues the most vicious thug, but also brands him for identification in case he should escape. When he is struck with the club-shaped weapon, an airtight membrane breaks, releasing a chemical similar to tear gas and also a spray of aniline dye that indelibly stains his face, hands, and clothing, thus identifying him.



## Autos Run on Treadmill in Accurate Speed and Fuel Tests



WITH a gale of wind rushing past, German cars now roar at mile-a-minute speeds on rolling roads and never move an inch! The scientific treadmills were designed by automotive engineers for super-accurate tests of high-grade cars. The rear wheels of the machines, spinning on revolving rollers, meet with conditions that remain exactly the same throughout the tests, thus permitting a more accurate record of performance and fuel consumption than can be obtained on ordinary highways. During the experiments, a huge electric fan, facing the cars, sends a gale of cooling wind through the radiators.



Rollers set in this treadmill revolve beneath the rear wheels of an auto during speed and fuel tests. At upper left, big electric fan sending gale of wind through car's radiator while it runs on treadmill

## BLIND HEAR PRINT AS MUSIC



BY TRANSLATING printed letters into musical sounds, an English invention, called the "optophone," reads books to the blind. A book to be read is placed face down upon a rest at the top of this device. A scanning disk and an electric eye, or photo cell, detect the form of each letter and produce a musical equivalent. Thus a capital "I" is heard as a chord of four notes. A capital "V" is represented by the same notes, heard one at a time. Blind students are said to learn to interpret the sounds readily.

## CABLE AND HOIST WORK NEW STUMP PULLER

OPERATING like a nutcracker, a new stump puller eliminates the use of explosives and pulls a stump in less than two minutes. To uproot a stump, a drag cable first pulls a pair of hinged arms together until their edges are imbedded in the wood. With a continued pull on the drag cable, and with a hoist cable held taut, the stump is lifted out of the ground. About 400 stumps can be pulled in a day and the land left clean for plowing.



Below, nutcracker-like jaws of stump puller which is seen in use at the left



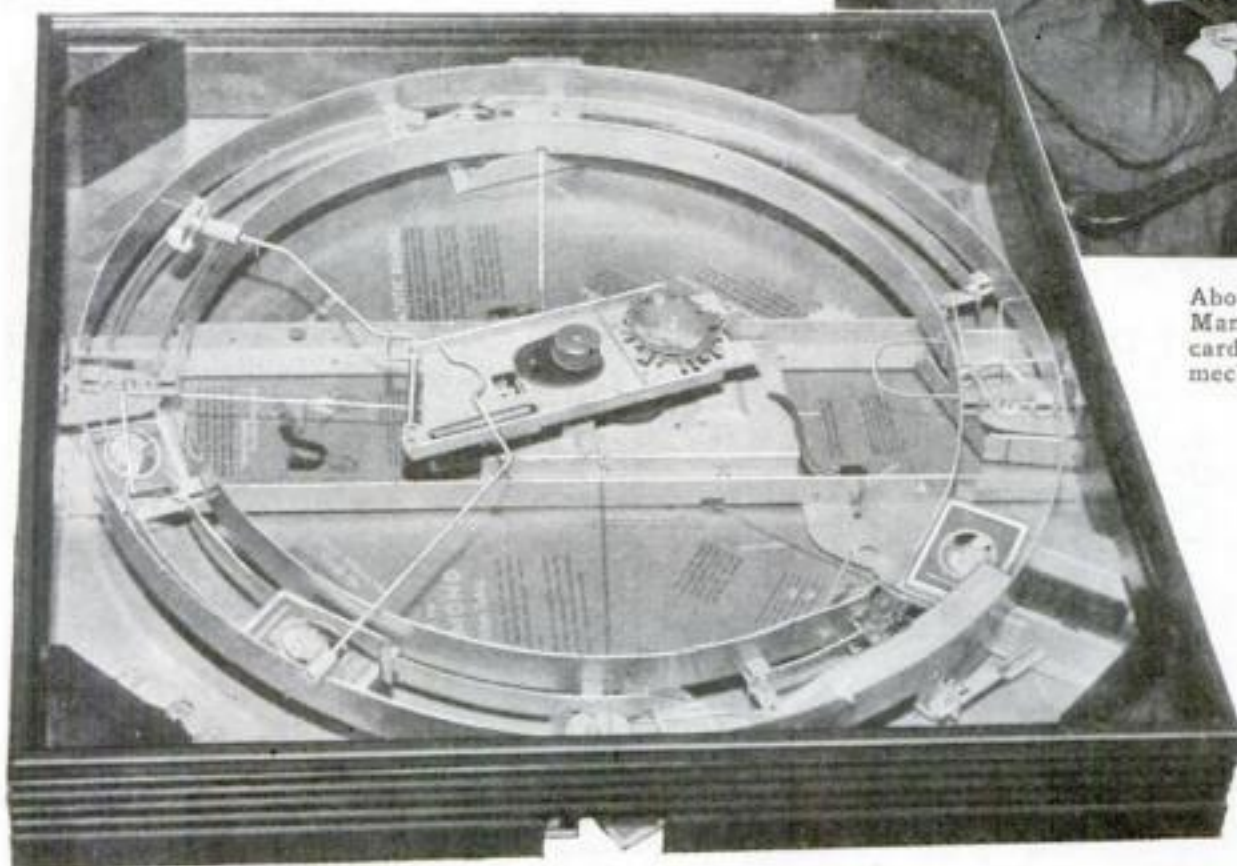


## Automatic Bridge Table Shuffles and Deals Cards

A BOON to impatient bridge players is a new electrified table that shuffles and deals the cards automatically. So smoothly and rapidly is this accomplished that a new hand is dealt by the time the used pack has been picked up, thus speeding up the game and making it more lively and interesting. Any household outlet furnishes current for the table. The heart of its remarkably ingenious mechanism is a tiny electric motor, that starts of its own accord when a pack is inserted



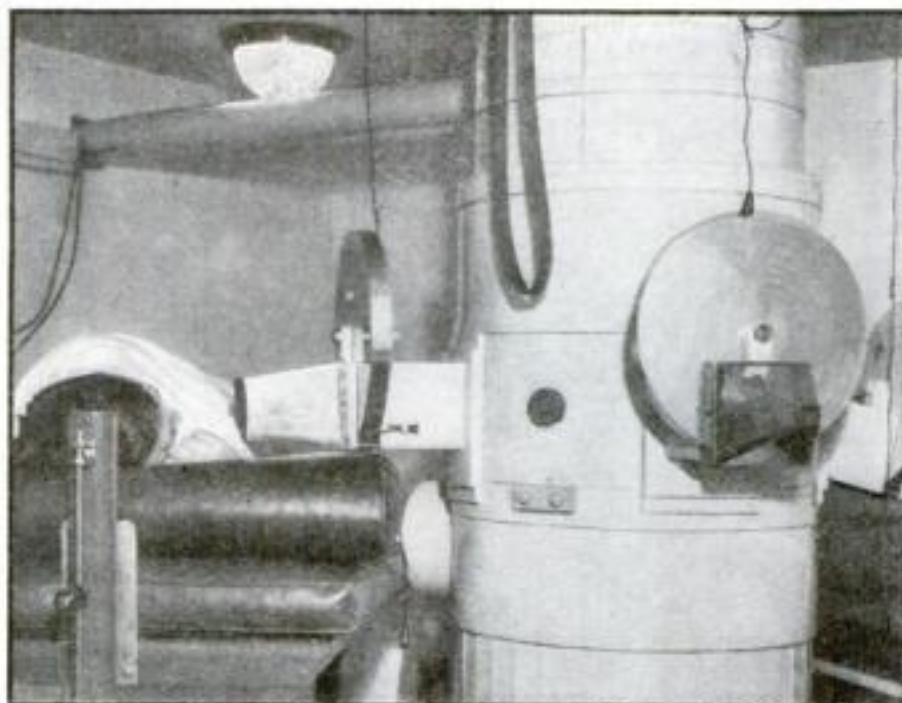
Above, players using electrified bridge table. Man at left is receiving a hand while girl inserts cards for next deal. At left, close-up of the mechanism that distributes cards to players



in a corner drawer and the drawer is closed. A magic arm picks up the cards, shuffles them, and delivers them to receiving compartments in front of each player. This is done by distributing them at random instead of in rotation, stopping when each player has thirteen. The mechanism is so contrived that nothing but the laws of chance can influence the distribution of cards, insuring a fair deal. According to the makers, more than 535 billion different hands of thirteen cards can be dealt by the machine, one hand being as likely as another to appear.

## TREAT CANCER WITH BIGGEST X-RAY TUBE

TREATMENT of cancer patients has just begun at the California Institute of Technology, after months of preparation, with the biggest X-ray tube in the world. Artificial lightning of 1,000,000 volts operates the thirty-foot instrument. This is the highest voltage ever harnessed for medical use, and spectacular displays of sparks are to be seen in the adjoining room where the current is stepped up by two transformers. Radiation from the tube is declared more powerful than the rays that would be obtained from all the radium in the world. The unprecedented voltage gives the rays extremely deep penetration. Rats were subjected to the rays in lengthy tests before the tube was applied to human beings.



Windows in the vertical thirty-foot tube, left, emit X-rays to treat cancer patients. Above, million volt discharge from machine that runs the big tube



## ELECTRIC PLUG CONTAINS FUSE

A SHORT-CIRCUIT in a household iron or toaster will not plunge the room into darkness when a new connector plug is used. The plug contains a pair of miniature fuses of such a rating that they will blow, and thus disconnect the appliance from the household circuit, before the fuses in the main wiring system are affected and the current supply cut off.



## New Auto Tire for Heavy Machines Contains No Air



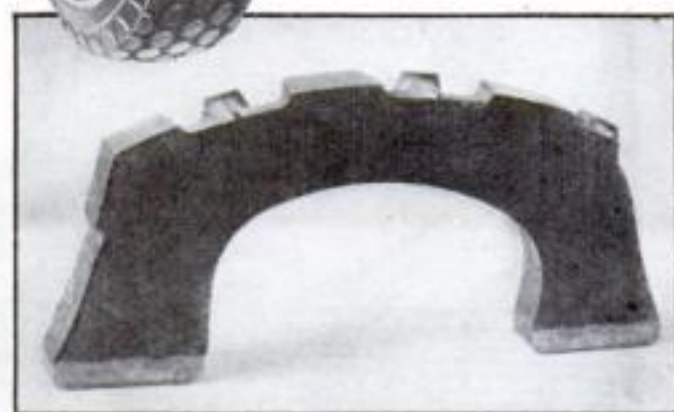
This road grading machine is equipped, to absorb shocks, with a recently designed tire in which there is no air pressure



## FLAT MICROPHONE HELPS DEAF HEAR

BY ENABLING people to hear through their bones, a new electric invention aids the partially deaf. The device consists of a flat microphone not much larger than a spectacle case, that may be concealed beneath a dress or in a pocket; a small battery; and a tiny electric oscillator that is set in vibration by the sounds received in the microphone. When the oscillator is held against the forehead or pressed to the head just behind the ear, any word spoken nearby is heard distinctly by the user. The oscillator may be worn with a headband, or hung like a lorgnette on a

necklace. The latter method is the one illustrated below. According to Dr. Hugh Lieber, the inventor, the device will enable many deaf persons to hear.



Close-up and cross section of zero pressure tire, showing construction that gives it desired resiliency



At top oscillator and below it microphone that helps deaf persons hear

## POLICE USE RADIOPHOTO

SENDING photographs by radio is the new quick way of identifying criminal suspects. A demonstration of the method was given recently in New York by the National Identification Association. A man's photograph, his signature, and samples of his fingerprints were transmitted by radio upon one card.



Photo, signature, and fingerprints are sent by radio in latest method of identifying suspects

## PROFILE GAGE SHOWS OBJECT'S SHAPE

HANDY in shop and factory is a new profile gage with which the contour of any object may be temporarily or permanently recorded. In use, a tension nut is loosened and the laminations of thin metal that compose the gage are pressed against the object until they take its shape. The nut is then tightened and the instrument removed so that the pattern may be transferred to paper, wood, or linoleum. While the device is especially intended for carpenters and machinists, others will find it equally useful.



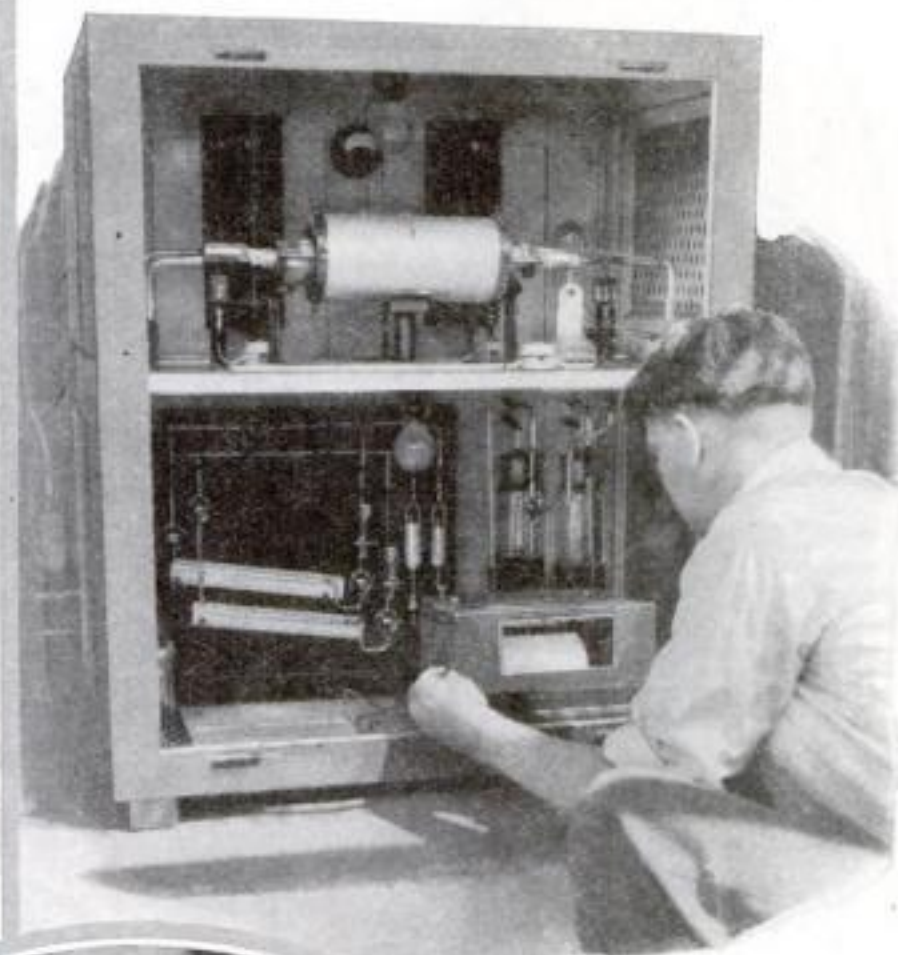


# Oil and Kerosene Made to Order

*Startling New Process Tears Molecule Apart and Recombines It To Create Synthetic Fuels*



First published photograph of the gun-like reaction towers that rise within concrete stalls. Within the seven-inch alloy steel walls of these forty-foot towers, hydrogen and oil, at 3,600 pounds pressure per square inch and at temperatures up to 1,000 degrees, are forced to combine and thus form products hitherto found only in nature



Here is an oxygen detector, one of the safety devices to keep the reaction towers from blowing up. This gage is constantly on the job and sounds alarm before danger point is reached



Above, two different types of the catalysts that are packed in the reaction towers to make possible synthetic oil. At left, sample of dark crude oil and beside it, clear oil that is produced from it

WITH the birth in this country of a new industry devoted to the manufacture of synthetic petroleum products, among them a "tailor-made" motor oil, a new chapter is written in the dramatic history of "hydrogenation."

Born of a war-ridden country's desperate need, this amazing process of synthetic chemistry all but won the world war for Germany. It enabled her chemists to make explosives for her big guns with nitrogen captured from the air, after Allied blockades shut off her supply of Chilean nitrates. Mystery still clung to the process years after the war. Industrial chemists, seeking peacetime applications, guarded their secret experiments from prying eyes.

How far it has been developed at the Bayway, N. J. plant of a great oil company is revealed by a recent announcement. Its engineers now literally tear apart molecules of crude oil and re-form them at will into new and valuable compounds, of which four are already being manufactured on a commercial scale. They include a synthetic motor oil said to be especially

adapted to the high compression and power of modern automobiles; a hydrogenated "safety fuel" for aircraft and motorboats; a superior, synthetic kerosene; and a series of hydrogenated solvents for the paint, varnish, and other industries. Soon to appear on the market is a hydrogenated aviation oil.

What is hydrogenation? To the chemist, it means a process in which hydrogen gas is forced into reluctant chemical combination with nitrogen, with coal, or with petroleum, to form brand-new substances. To the layman, as applied commercially at the Bayway plant, it takes on the fascination of titanic forces at work.

cannon is not accidental; they were made in a gun factory. Their massive walls, seven inches thick, are designed to withstand a pressure of 3,600 pounds to the square inch and temperatures of 750 to 1,000 degrees as the hydrogen and petroleum are forced together through a packed catalyst—a white substance, resembling lumps of sugar, that, mysteriously aiding in the reaction, is afterward recovered without the loss of any of it.

If only five percent of oxygen entered the reaction towers, they would be likely to blow up. Special oxygen detectors constantly stand guard over the daily stream of 5,000,000 cubic feet of gas—about the same amount that is consumed by the whole population of Cambridge, Mass.—that is pumped into the towers. Before the oxygen proportion ever becomes perilous, a siren sounds and the tower is shut down until cleared of its contents.

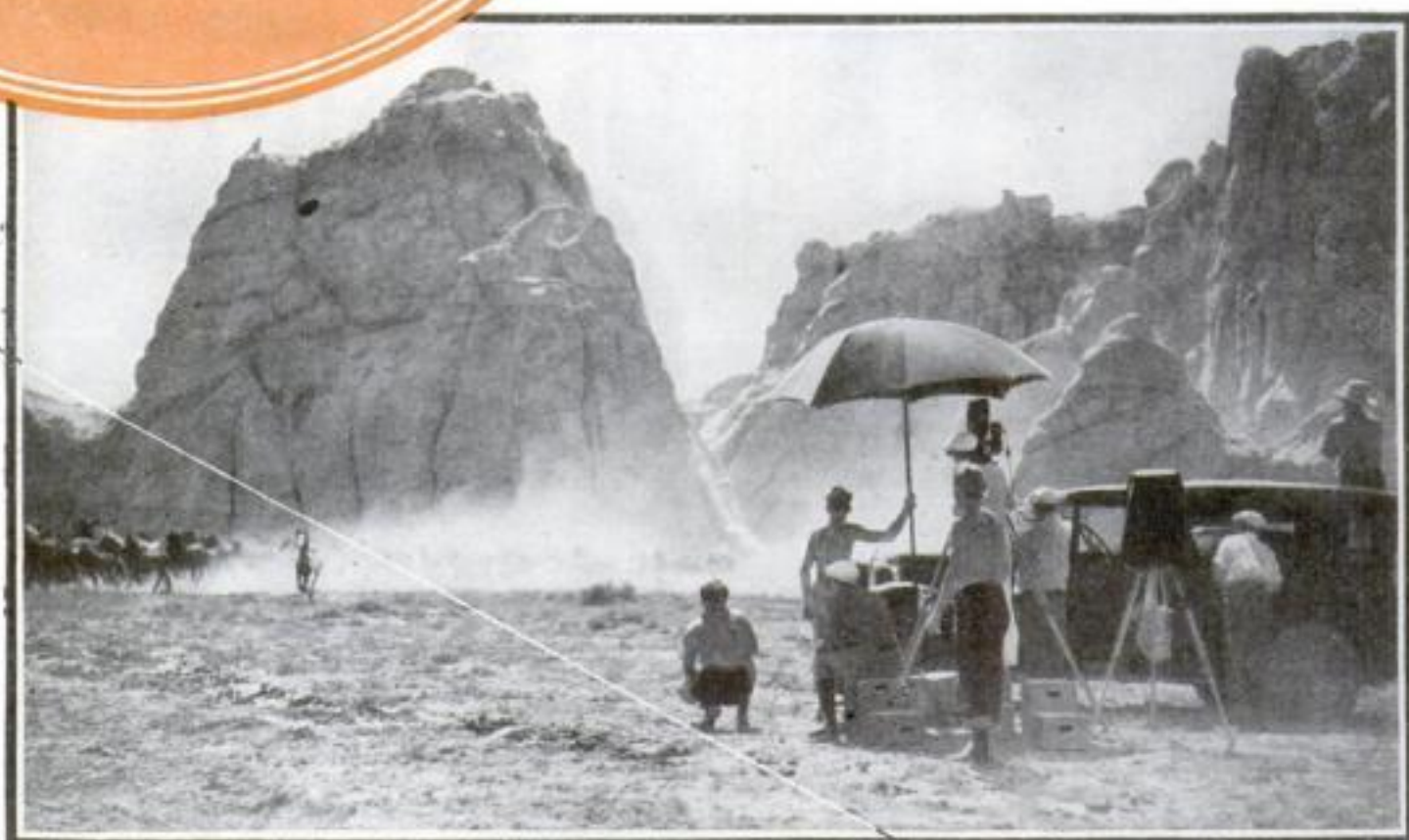
Successful laboratory experiments pre-  
sage new wonders of hydrogenation. When wells have sucked the earth's crust nearly dry of petroleum, hydrogenation will turn coal into oil, and oil into gasoline, as small-scale tests have shown.



By ANDREW R. BOONE

**S**OUND Cameras Grind as Hundreds of Ponies Thunder Along in Race for the Hills—Lead Taken by an Untamed Animal That Figures in Savage Fight with Actor-Dummy to Give Air of Grim Reality

# Wild Horses in



Here they come! A herd of wild horses thundering down the valley, sweep past the cameras and are caught for the screen

**E**IGHTEEN hundred wild horses recently stampeded down an

Arizona canyon to provide a thrilling climax for a Hollywood talkie. In the picture, they thunder across the silver screen for only a few tense moments. But to make those moments possible, half a hundred Navajo Indian wranglers, a dozen veteran cowboys, more than two miles of wood and bunting fence, and a trained "wild stallion" of the studios, were required.

For weeks before the cameras arrived, the Navajo wranglers were scouring the bare uplands along the Arizona-Utah border, driving the wild ponies southward, herding them into Blue Canyon, 150 miles north of Flagstaff. Lured by an offer of two dollars a day for each man, fifty cents a day for each saddle horse, and ten cents a day for each wild pony, the Indians moved to the canyon, bringing families and baggage, ready to stay as long as they might be needed.

One end of Blue Canyon is a pocket in the hills which forms a natural trap. Across the narrow entrance a heavy forty-

foot gate was built with 200-yard wooden fences extending out fan-like on either side. From the far end of these fences, barriers of bunting were carried on for nearly a mile. Thus, once the stampeding horses reached the wide mouth of this funnel, I was told as I watched preparations for the filming, they would feed down it into the trap. Four miles away, at the other end of the canyon, fifty riders guarded the milling, restless ponies night and day until everything was ready.

The script of the picture, Columbia's "Wild Horse Stampede," called for Rex, the trained twelve-year-old stallion, to turn the stampeding herd back from sure capture in the trap, prepared by brigands who are attempting to round up



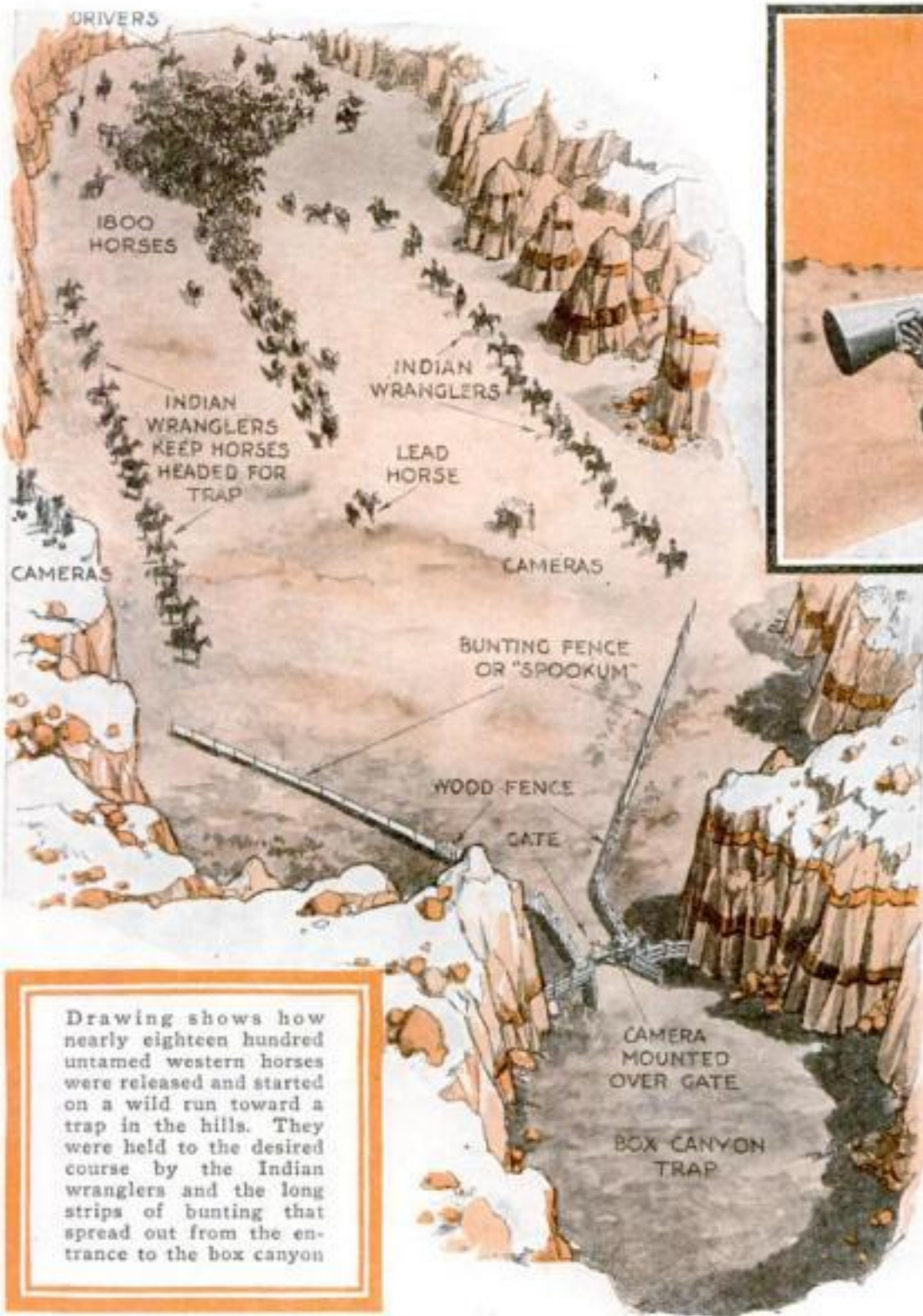
the wild horses and kill them.

The director, Earl Haley, told me he counted on the stallion's natural intelligence and leadership to halt the stampede in its headlong flight and turn the charging herd back away from the trap. During the





# Stampede *for* Movies



Earl Haley, center, and assistants directing the stampede

morning of the day when the filming was to be done, Rex was run over the course and into the trap. When the heavy gate slammed behind him, he examined his enclosure intently and when he was released trotted back to the herd.

Now, all is ready. On a low hill, midway between start and finish, Haley signals to an assistant. A gun barks and at the signal ten cowboys, swinging sombreros over their heads, dash into the fringes of the herd, turning the frightened animals down the canyon. In a rising cloud of dust, the 1,800 horses race toward the cameras.

Rex has taken the lead. With black mane streaming, he runs a dozen paces in front of the wild-eyed, stampeding ponies. One mile, two miles, three miles they rush, their hoofbeats building up in the microphones with increasing volume. Far across the valley, Indian riders, outside the cameras' range, keep pace with the approaching herd, alert to turn back any stragglers.

Now, the herd is inside the wide mouth of the funnel. A leader unfamiliar with the trap would certainly have led them through the gate. But



Rex sees the wooden fence and the fiery little black wheels to one side like a cat. With the whole herd swirling in his wake, he swings to the left. In an instant, the animals are thundering back again along the canyon while the whirring cameras swing to picture their retreat. Everything has worked out just as had been planned.

The next day, 600 horses were cut from the herd and preparations made for a second stampede. In this case, another Hollywood horse, Marque, was to betray the band and lead it into the trap. At the last moment there was some delay at the cameras. The horses grew restless. Suddenly, as the ten riders strained to hear the starting gun, two of the animals began to bite and kick. Others in the vicinity, struggling to escape, started up a nearby hill. In a few moments, the whole 600 horses were in mad flight up the precipitous cliff.

**N**EARLY 300 feet they climbed, their hoofs catching in little rainwashed crevices that lined the face of the hill. The crest offered them no haven of safety, however, for those behind pressed the leaders, forcing them down the other side which was so steep the ponies sat on their haunches and literally slid to the base.

The ten riders had no way of reaching the escaping horses. Their mounts could

not carry them up the steep incline. Finally, a lone Indian rode his mustang up the cliff. He found the other side was too steep for his horse to carry him down and had to dismount and slide ahead of the pony to the bottom. In an hour, by hard riding across the plain, he rounded up the band and herded it back around the end of the cliff from where the cowboys drove the animals back to the starting point.

**I**N SPITE of their wild scramble up the cliff and their long run across the plain, the wiry little horses were ready for the dash down the canyon and an hour later were milling, kicking and crowding within the enclosure of the trap. As soon as the thumping and squealing of the captured horses had been recorded through the microphones, they were released. Haley knew that after the wild horses had been trapped once, they could not be enticed near the enclosure again.

Another 600, the following day, were herded to the starting point. This time, Rex was scheduled to run in from the sidelines just as the band reached the wooden entrance, and again turn them back from the trap into which they were headed.

No Hollywood actor could have performed his bit with greater sureness. In the distance, Rex could hear the swelling thunder of hoofbeats. His neck arched; his feet stamped the ground. Jack Lindall, his trainer, held him quietly with a halter. Then, just as the main body of horses entered the wings, Haley, standing a quarter of a mile away, out of the line of the cameras, twirled a whip as though beckoning to him.

Into the funnel,

dashed the stallion. Directly in the path of the onrushing herd, he paused, head high and eyes wide. With a quick glance toward the trap, he took rapid flight in the opposite direction, wheeling the herd in his wake.

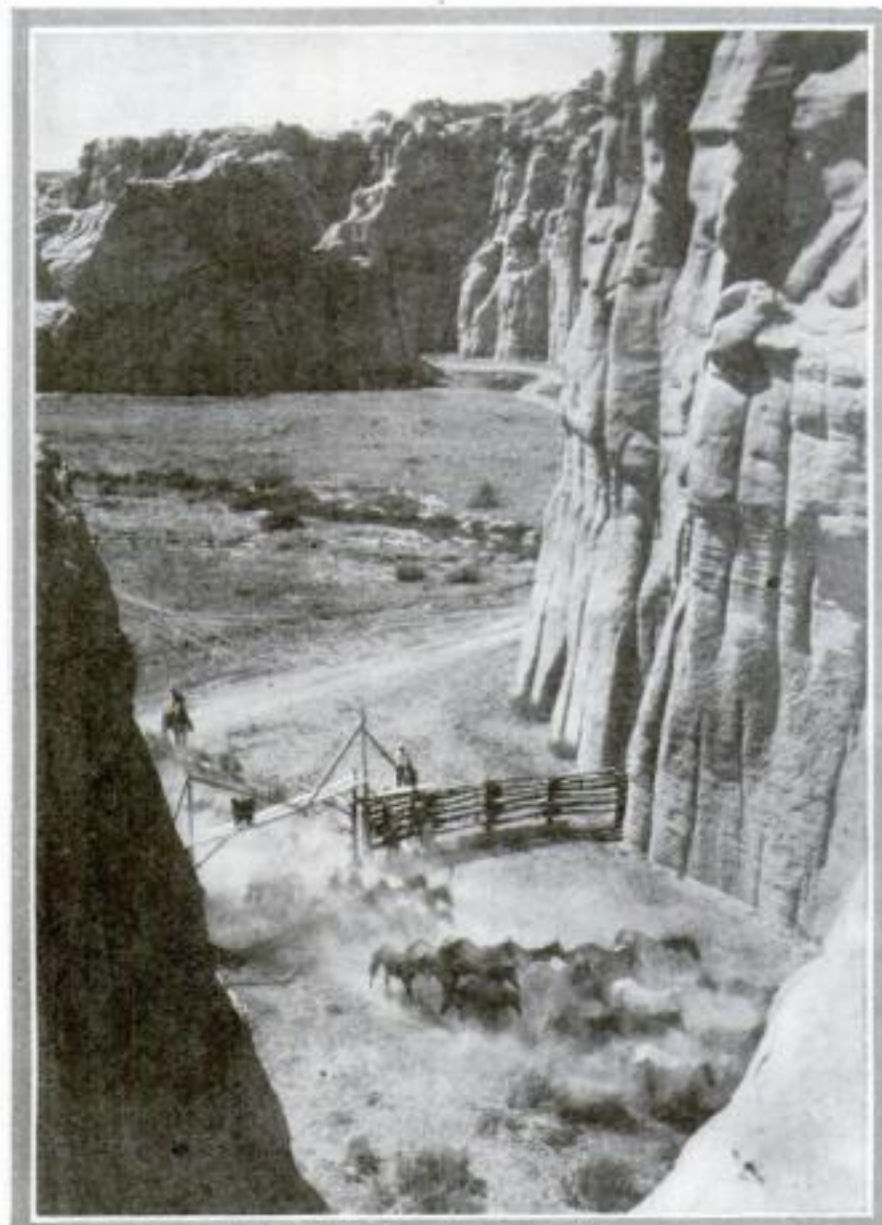
Later in the filming, with all the ferocity of actual conflict, the black stallion demolished dummies of a lion and a man.

In the latter case, a trick added to the realism of the scene. The villain of the talkie is shown riding one of Rex's two doubles. The horse shies and throws the rider. As though the real killer-horse, Rex, were after him, the actor races for a protecting cliff but falls just before he reaches it and lies very still.

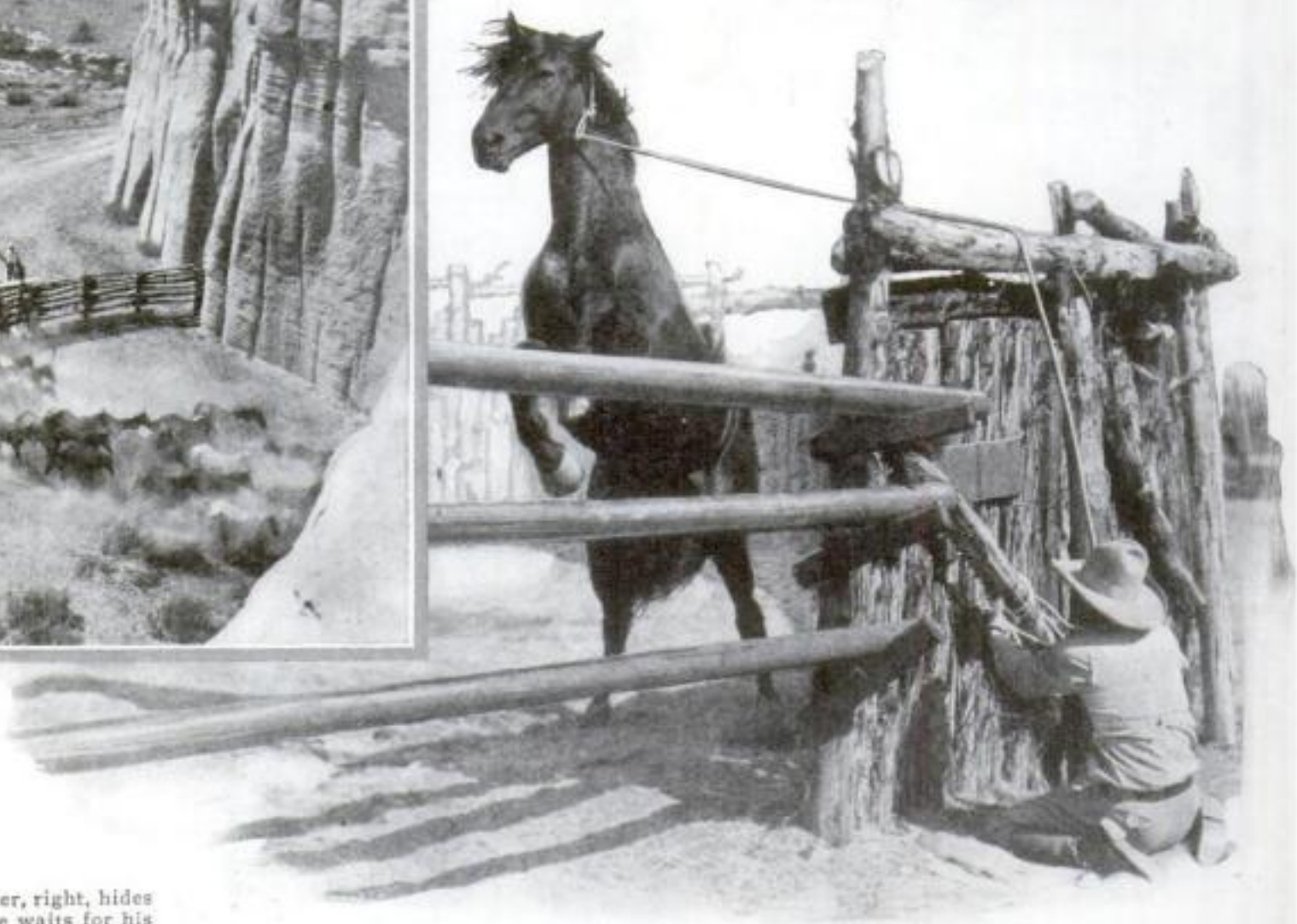
**A**FTER the cameras have recorded his fall, a dummy is placed in the same position and Rex enters the picture. One cue that always enrages Rex is for Lindall to point the stock of his whip at his face. His eyes flash, he bares his teeth, and advances toward the trainer. But when the whip is reversed, he always follows the direction the whip points. Now, after leaving Rex and going through the motions of kicking the dummy, Lindall pokes his whipstock toward the horse. It rears and seems to snarl. Before its mood can change, Lindall points toward the dummy.

Rex rushes upon it, sinks his teeth into one boot and hurls the body high in the air. Hardly has the dummy struck the ground before the coal-black stallion, its ears laid back, lands on its chest with both fore-hoofs. It is still biting and kicking the dummy when the cameras stop.

In all, during the ten days the company was on location in the Blue Canyon, it recorded nine separate stampedes in which the wild horses pounded, whinnying and squealing, past cameras and microphones. In the end, all the wild ponies were turned loose to return to their highland ranges after their brief appearance as unrehearsed stars of a thrilling drama.



Through this forty-foot gate into the trap, groups of six hundred horses at a time were stampeded and automatic camera above entrance made permanent record of their capture

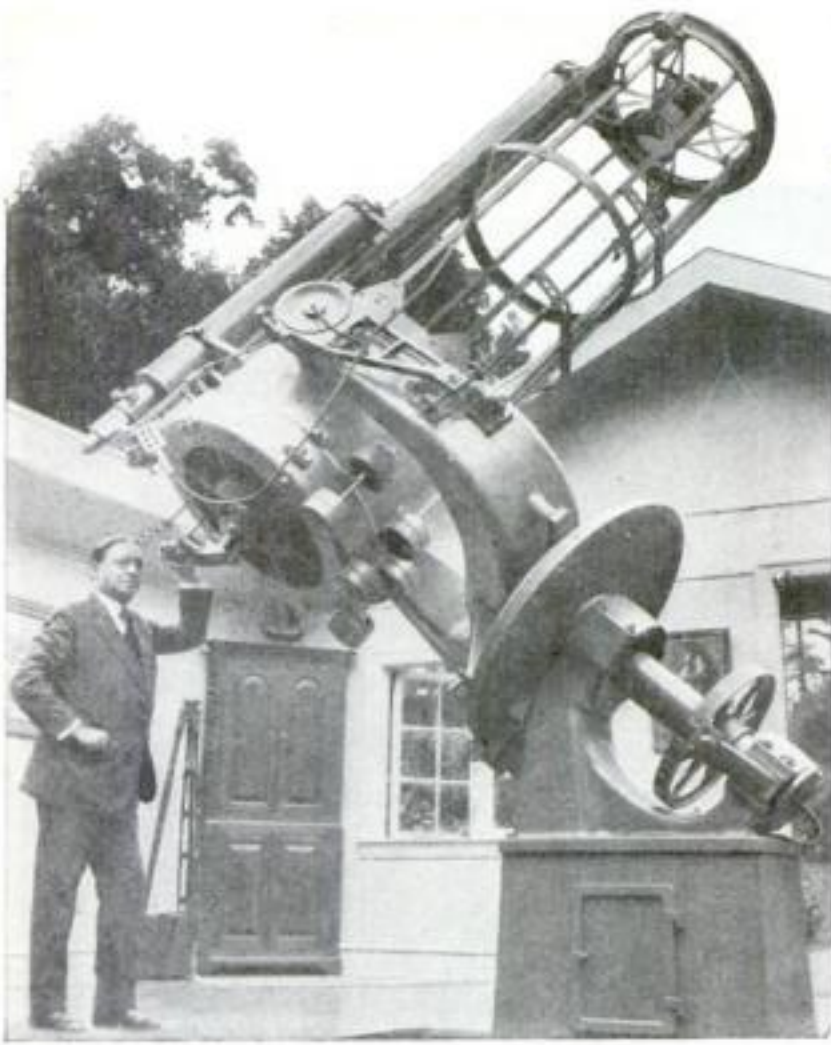


The black stallion's trainer, right, hides behind the fence while he waits for his rope to subdue the man-killing horse

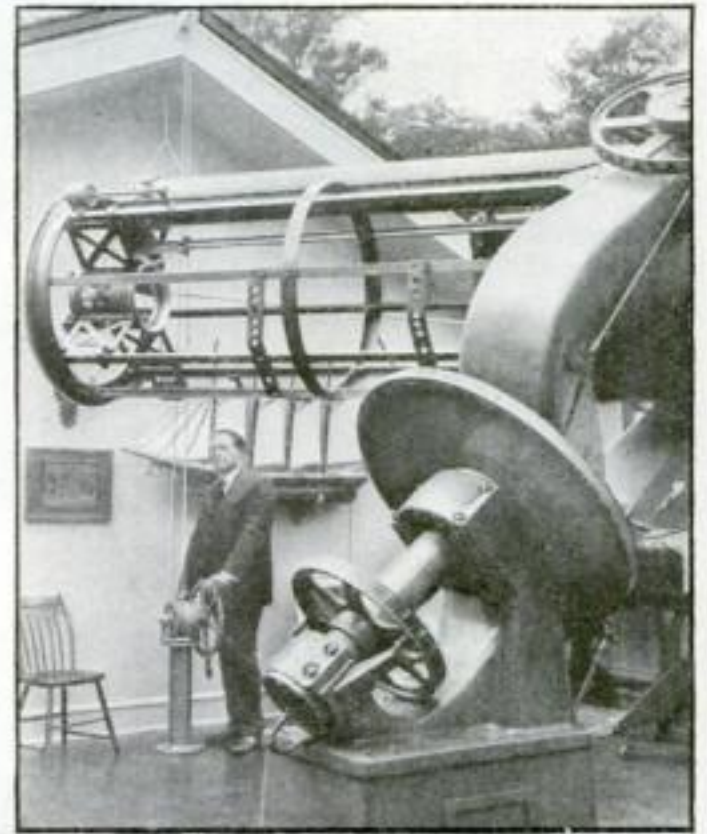


## UNUSUAL OBSERVATORY HOUSES

# Amateur's Big Telescope



Left, G. W. Cook, Wynnewood, Pa., is standing beneath his twenty-eight-and-a-half-inch telescope which, weighing over four tons, is housed in his observatory



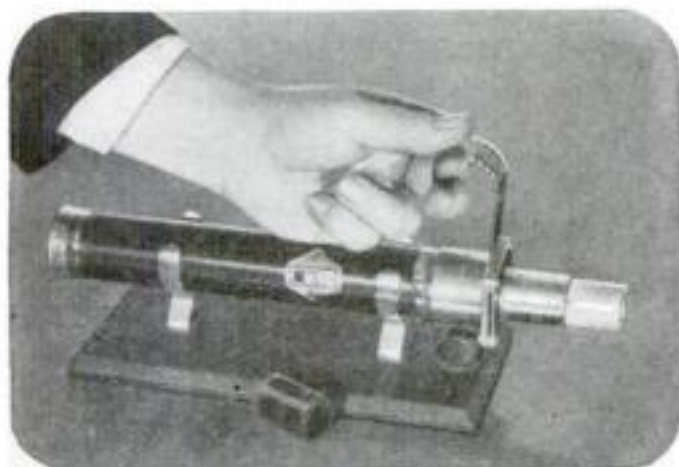
Right, the telescope in position it occupies when not in use. Cook is seen near a wheel, a few turns of which slide the roof of the observatory, shown below, out of the way exposing the stars for observation

**T**O HOUSE what is called the largest telescope of its type in the East, G. W. Cook, amateur astronomer of Wynnewood, Pa., has constructed a private observatory. When he wishes to look at the stars, he gives a few turns to a modified steering wheel mounted on a pedestal. The whole roof slides out of the way on heavy bearings. Despite the lightweight alloy used in its construction, the twenty-eight-and-a-half-inch diameter telescope weighs four tons. It has the power to enlarge an object 1,400 times. Built near his dwelling, the observatory is convenient for Cook's use.



## KANGAROO CAN JUMP 38 FEET

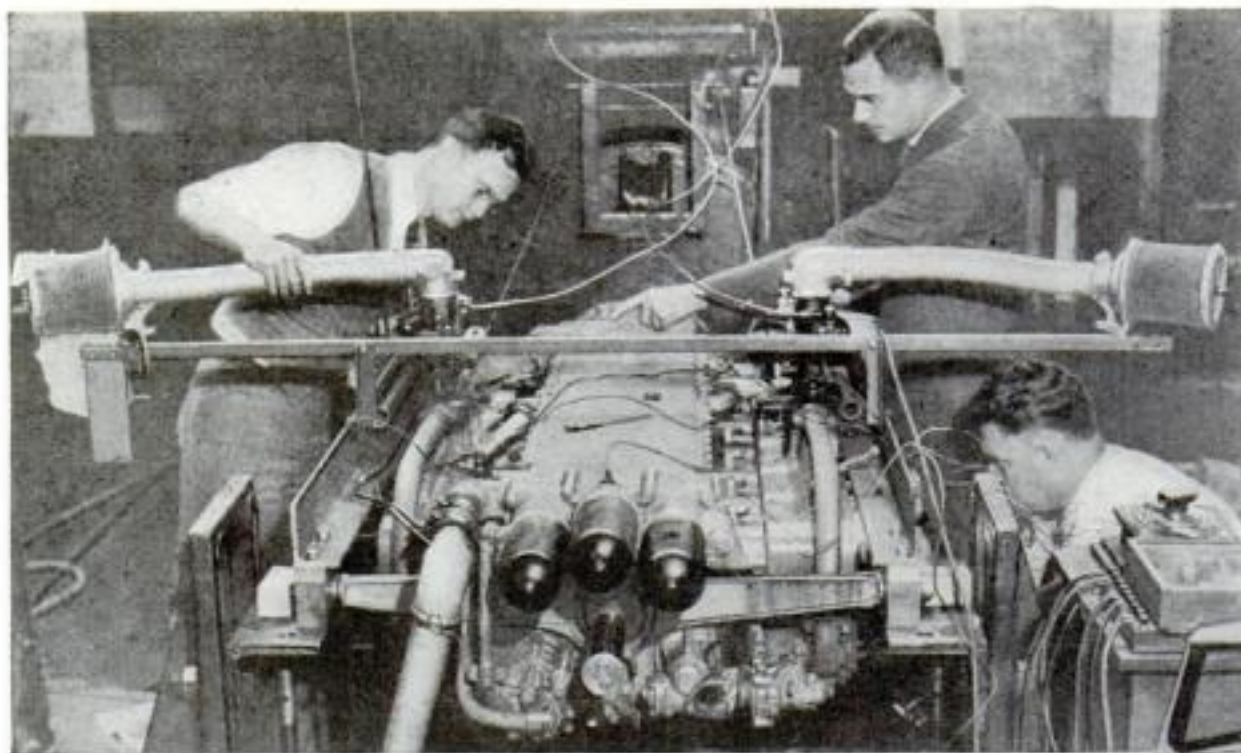
WHAT is the kangaroo's greatest jump? Recent observations by reputable observers credit the animal with leaps of thirty-eight feet, and the three kangaroos in the photo at the right, snapped during an Australian roundup a few weeks ago, seem well on their way to match the record. Tremendous development of the hind legs, as compared with the front ones, accounts for such jumping ability. So swift is the kangaroo, bounding across country in a series of leaps, that it is said to be capable of outdistancing a good horse. The animals are regarded as pests in Australia.



## FLASHLIGHT PROJECTOR

**BUILT** like a flashlight is a new portable projector designed to throw single frames from standard motion picture film on any convenient flat, white surface. Striking views may be snipped from movie films and exhibited with this device in the manner of a home lantern-slide show. Dry cell batteries of standard flashlight type are used in the projector, which may be held or snapped to a stand as shown.





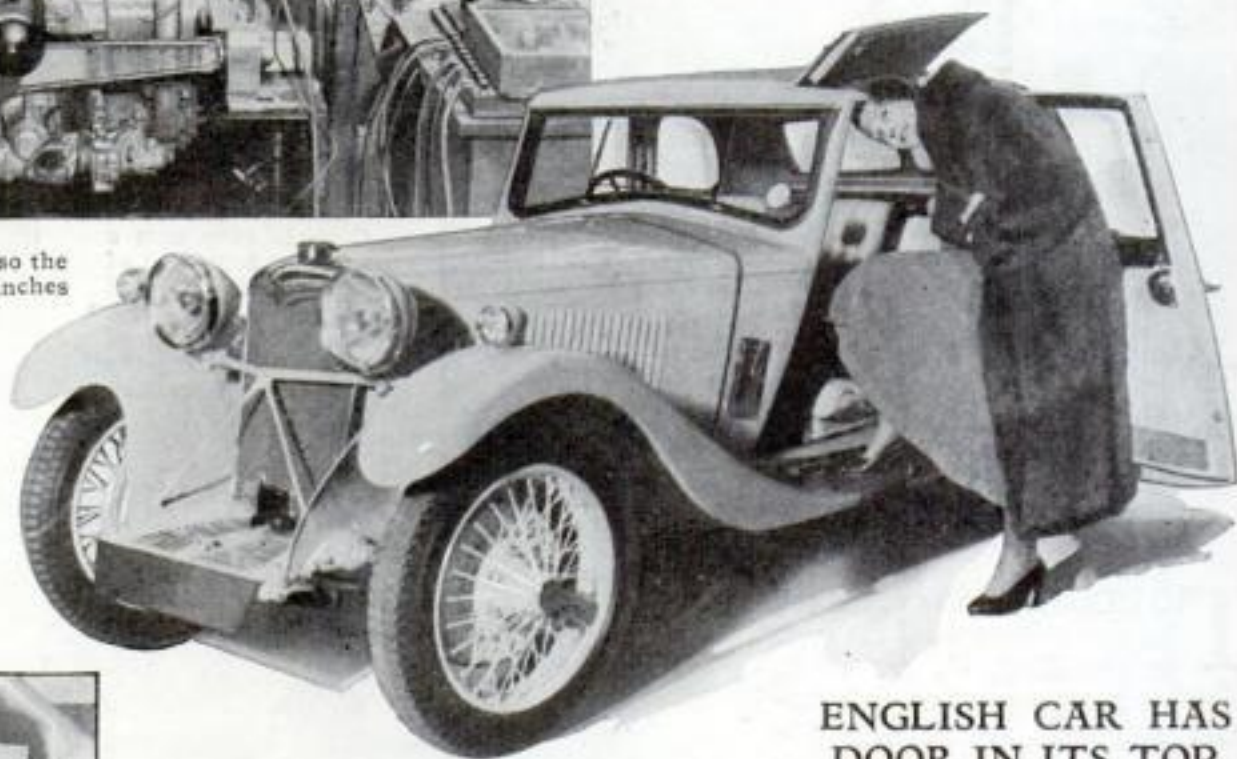
The twelve cylinders of this coach engine lie flat so the total height of the "pancake" motor is sixteen inches

## NEW MOTOR FOR COACH IS FLAT AS A PANCAKE

FLAT as a pancake, a twelve-cylinder engine for motor coaches was tested recently in a Cleveland, Ohio, factory. The cylinders are horizontally opposed so its total height is only sixteen inches. Thus, designers will be able to utilize all the floor space in a coach by placing the engine, and all its accessories, beneath the floor of the machine. The first coaches to be driven by the pancake power-plant will soon be given road tests at Cleveland.

## BANK'S BLACK BLOTTERS PREVENT FORGERIES

BLACK blotters now foil would-be forgers in a Seattle, Wash., bank. Hitherto a crook could follow a depositor into a bank and study his reversed signature upon a white blotter he had used, but on the black blotter the signature is invisible.

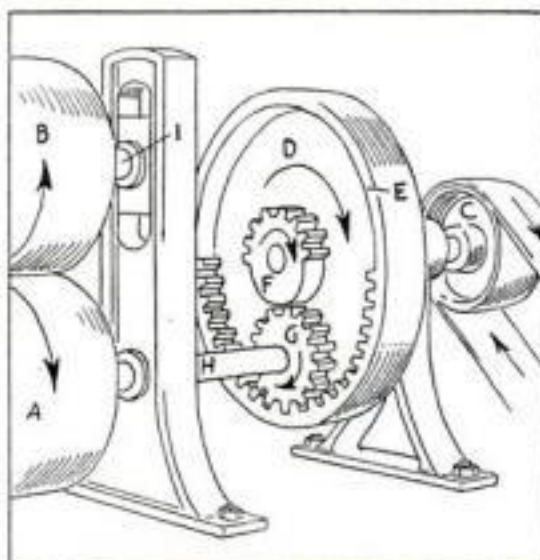
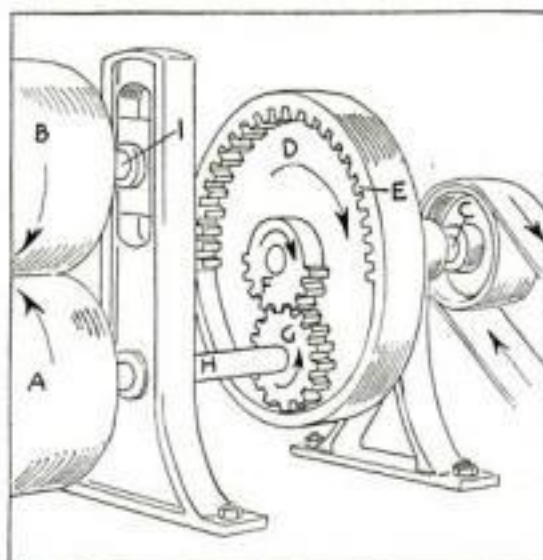


## ENGLISH CAR HAS DOOR IN ITS TOP

Doors in roof and side admit a motorist to a new low-slung English car, recently exhibited in London. As the side door opens, a section of the top above the door automatically tilts upward,

making entrance or exit easier. When the odd machine was placed on exhibition at the Olympia, not long ago, it attracted considerable attention, crowds gathering around the stand to watch the roof-door and the side-door work in unison.

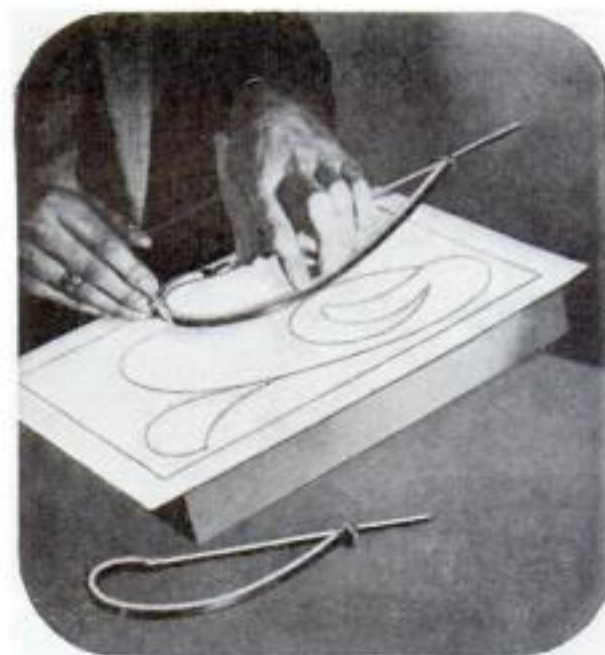
## MANGLE ROLLS CHANGE DIRECTION



Diagrams showing how mangle gears must be made to mesh and disengage so the rolls will turn slowly inward and reverse to turn outward with a much faster motion

HERE is the solution of the "Can You Invent It?" problem published in November. In that problem you were asked for the best way to make mangle rolls turn slowly in and then, reversing their motion, turn rapidly out. Necessary gear modifications, with the action produced, are shown in the diagrams above. It is evident

that the power transmitted to disk D causes the rolls to turn slowly inward when G is in mesh with F. When the teeth of G reach the toothless part of F, and start to mesh with the internal gear ring E, the direction of the rolls is reversed and the larger number of teeth in E will speed up the motion of the rollers.



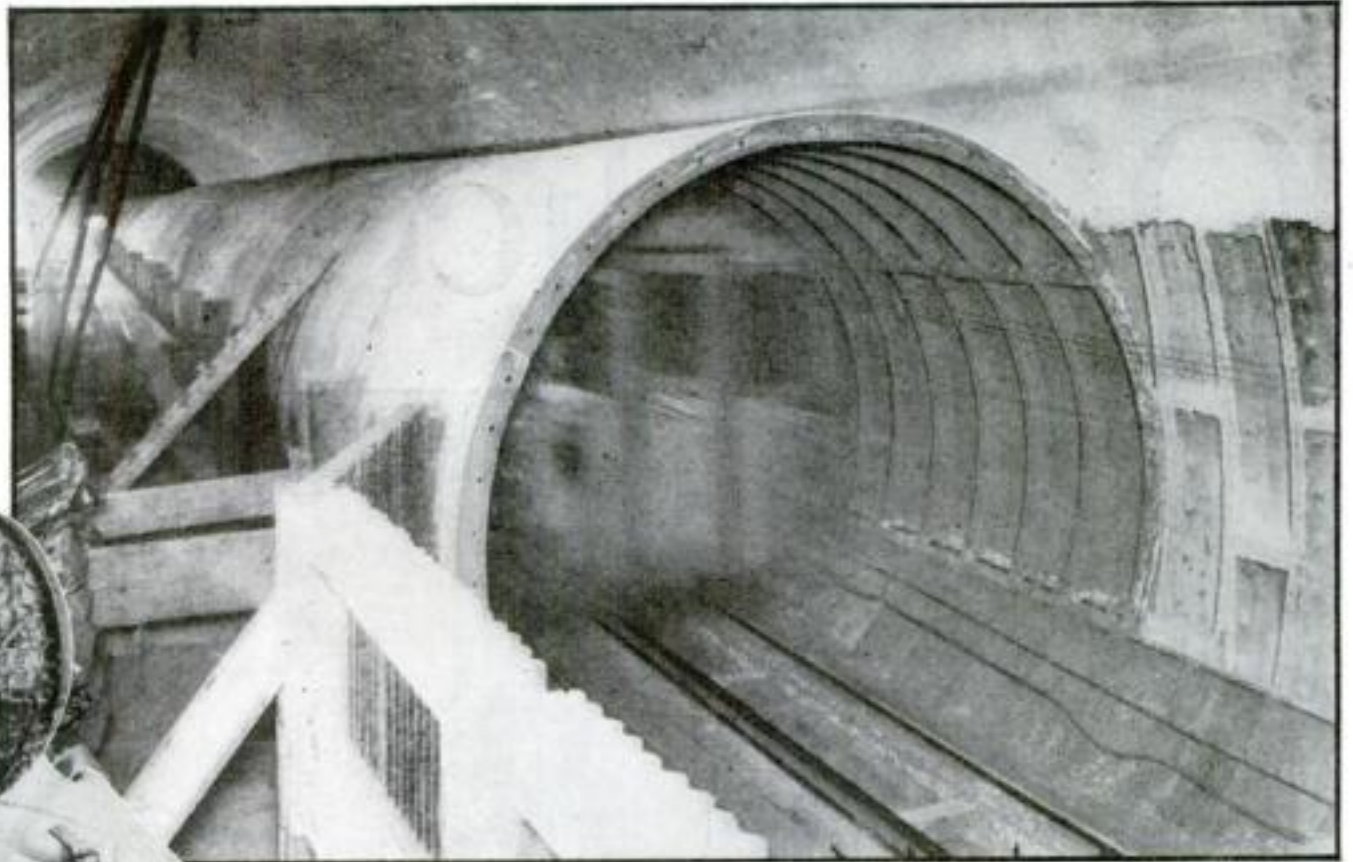
## STEEL BAND MAKES ODD CURVES EASY TO DRAW

ODD-SHAPED curves, beyond the draftsman's range with ordinary drawing instruments, are easily reproduced with the aid of a novel tool. By varying the position of a sliding anchor and locking it with a setscrew, a band of steel is automatically formed into one of a practically infinite number of curved shapes. Rubber backing forms a rest for the fingers, and also grips the paper. Sizes with a working edge up to thirty-eight inches long are available.



# Trains Never Stop as New Subway Is Built Around Old One

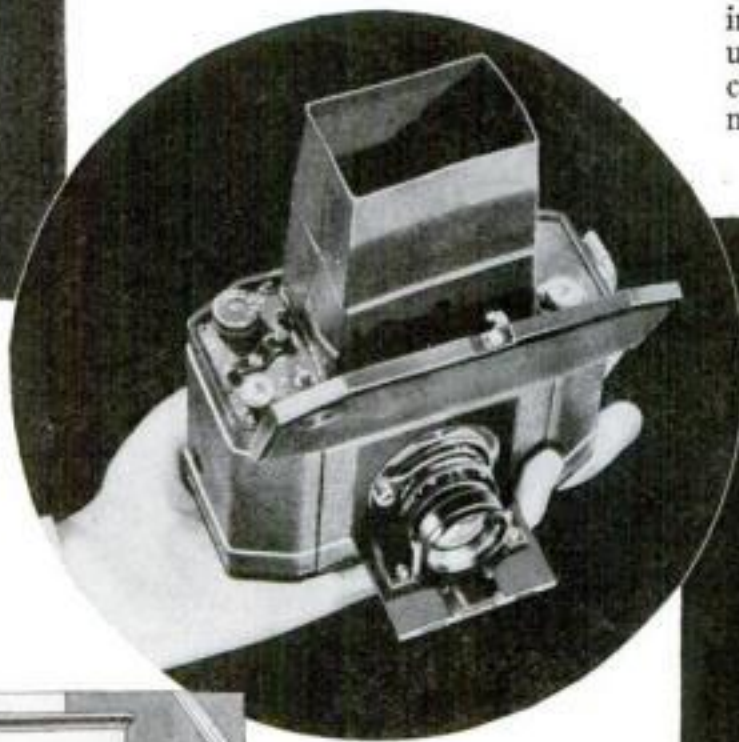
BUILDING a new subway around an old one, without disrupting train service, was the remarkable feat accomplished in London, England, during the recent rebuilding of one of the stations. The striking view reproduced here shows the task partly finished, with a train just passing through the half-demolished older tube. By doing most of the construction work at night, it was completed without even seriously slowing up the train schedules and at no time was service actually stopped.



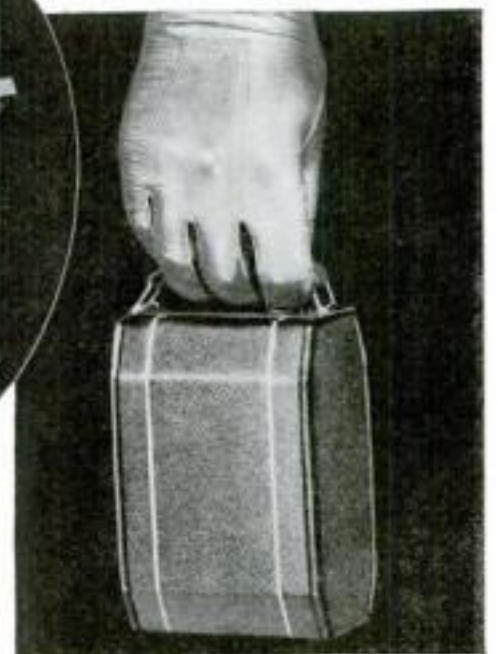
This unusual photo shows the new subway that is being built in London around the old tube, each of which is seen in picture, without interfering with the train service

## MIDGET REFLECTING CAMERA

SO COMPACT that it may be carried like a handbag when folded, a new reflecting camera dispenses with the bulk usually characteristic of this type, while preserving the ability to view the picture full size and right side up until the moment that the shutter is snapped. The midget model takes a picture two-and-a-quarter by two-and-a-half inches in size. It is equipped with a fast F/3.5 lens, and a focal plane shutter like those ordinarily used in larger models. An aluminum case is built into the camera which therefore needs no other carrying case.



Midget reflecting camera above, as it looks ready for use and, right, when folded compactly like a handbag



## PLIERS REMOVE WIRE STAPLES

REMOVING wire staples used in holding papers together, without damaging them, has been made easy according to the maker of a new tool. Extending inward at right-angles from the end of one jaw is a shovel-like projection which slips beneath the staple. When handles are then squeezed together the jaw pulls the staple.



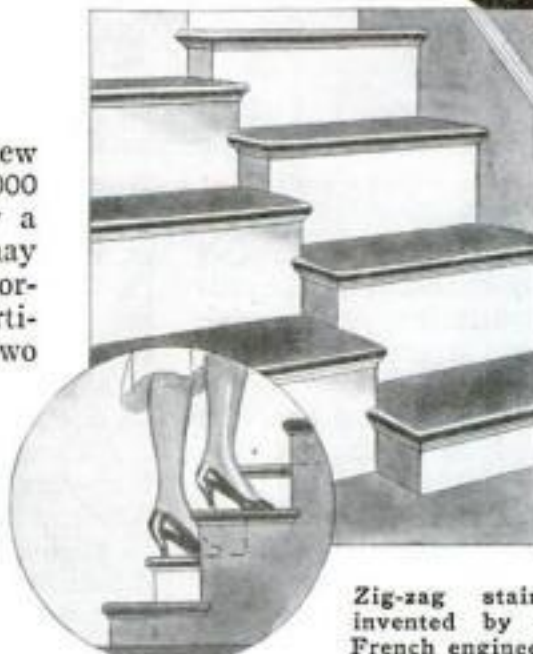
## SUIT GUARDS BOMB OPENER

DRESSED in his official costume, the German police officer charged with the responsibility of opening bombs found in the mail looks like an ancient warrior clad in armor. The mask and padding are designed to protect him if an explosion should occur, despite his delicate handling of an infernal machine. In the illustration above, a suspicious package is being opened.



## ZIG-ZAG STAIRS SAVE FATIGUE

WHAT is said to be the first new invention in stairways in 6,000 years, has been announced by a French engineer. His stairs may be visualized by imagining an ordinary flight of steps sliced vertically in two, and one of the two narrow sections raised the height of half a step. By stepping alternately on each side, according to the inventor, the user lifts his weight with less jerkiness and fatigue. The stairs are also more compact than the usual type.



Zig-zag stairs invented by a French engineer



# • PICKED MEN *trained to lead* Our Police *of the Sea*



COAST GUARD  
CADETS LEARN  
MANY THINGS

In the classrooms and workshops of the Academy at New London, Conn., cadets get practical experience in engine building, marine repair work of all kinds, and in the operation of electric motors and Diesel engines. At the left, students are being taught all there is to know about radio. Below, cadets are practicing with a lifeboat

By  
**Kenneth M. Swezey**

**O**N FORTY acres that overlook the Thames River at New London, Conn., west of the naval submarine base, north of the Coast Guard destroyer fleet, in an atmosphere saturated with traditions of the sea, Federal Government workers are now putting the finishing touches on a school of learning that is the only one of its kind in the world.

In this new \$2,500,000 Coast Guard Academy, picked young men from all over the country will be trained to track icebergs and smugglers, handle ships on the high seas, save lives and property from the fury of the deep. Theoretical military and technical training will go hand in hand with shop and laboratory work, gun practice, drills, and nine months of seamanship on the ocean.

When a man finishes creditably the prescribed course of instruction in this unique institution, he will be not only a good seaman and marine engineer, but also a responsible officer capable of carrying on the countless tasks assigned to the Coast Guard.

Conducted on barkentines and barks, steel cutters and schooners, with drill and classroom work in temporary buildings on shore, a school for the special training of officers in the duties of the Coast Guard has been in existence since 1876, when a two-year course was established aboard the topsail schooner *Dobbin*, of New Bedford, Mass. Old Fort Trumbull, overlooking the mouth of the Thames and New London harbor, has served as the land home of the Academy since 1910.



Coast Guard cadets, on training cruise, find a disabled American ship and tow it into port

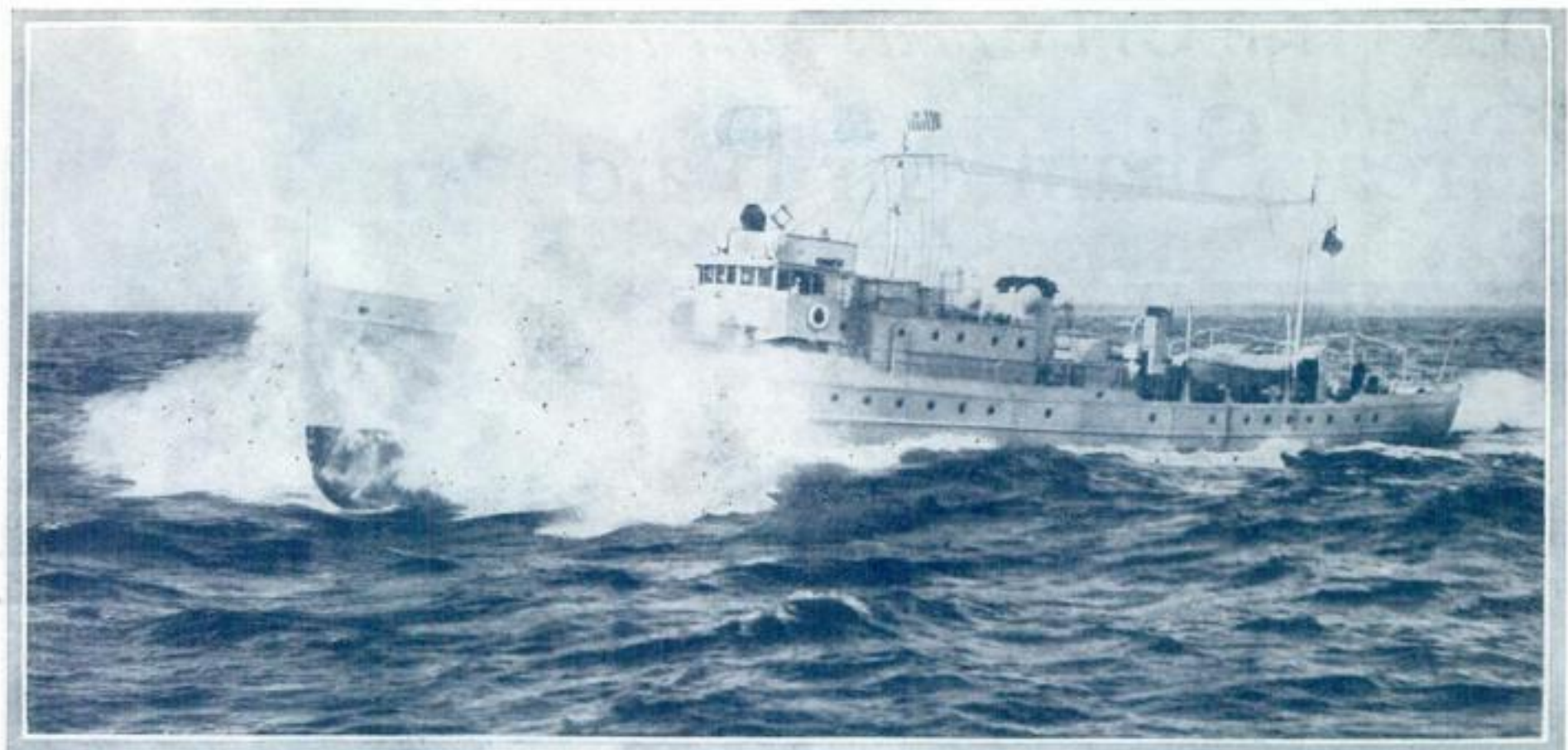
The new Academy differs from this school of an old day in that it is a beautiful, permanent institution, comparable with the famous academies of Annapolis and West Point.

Opened scarcely two months ago, the buildings already hum with activity. There, four classes, totalling 132 men, study mathematics, dissect engines, overhaul boats, discuss the niceties of international law, and learn to shoot the stars. Schoolmasters are regular officers of the service, selected for their ability to handle

men and to teach. The course of four years prepares a cadet for both line and engineering duties. Next May, the present upper class will be graduated; next June, youngsters in every state of the Union will be clamoring for admission.

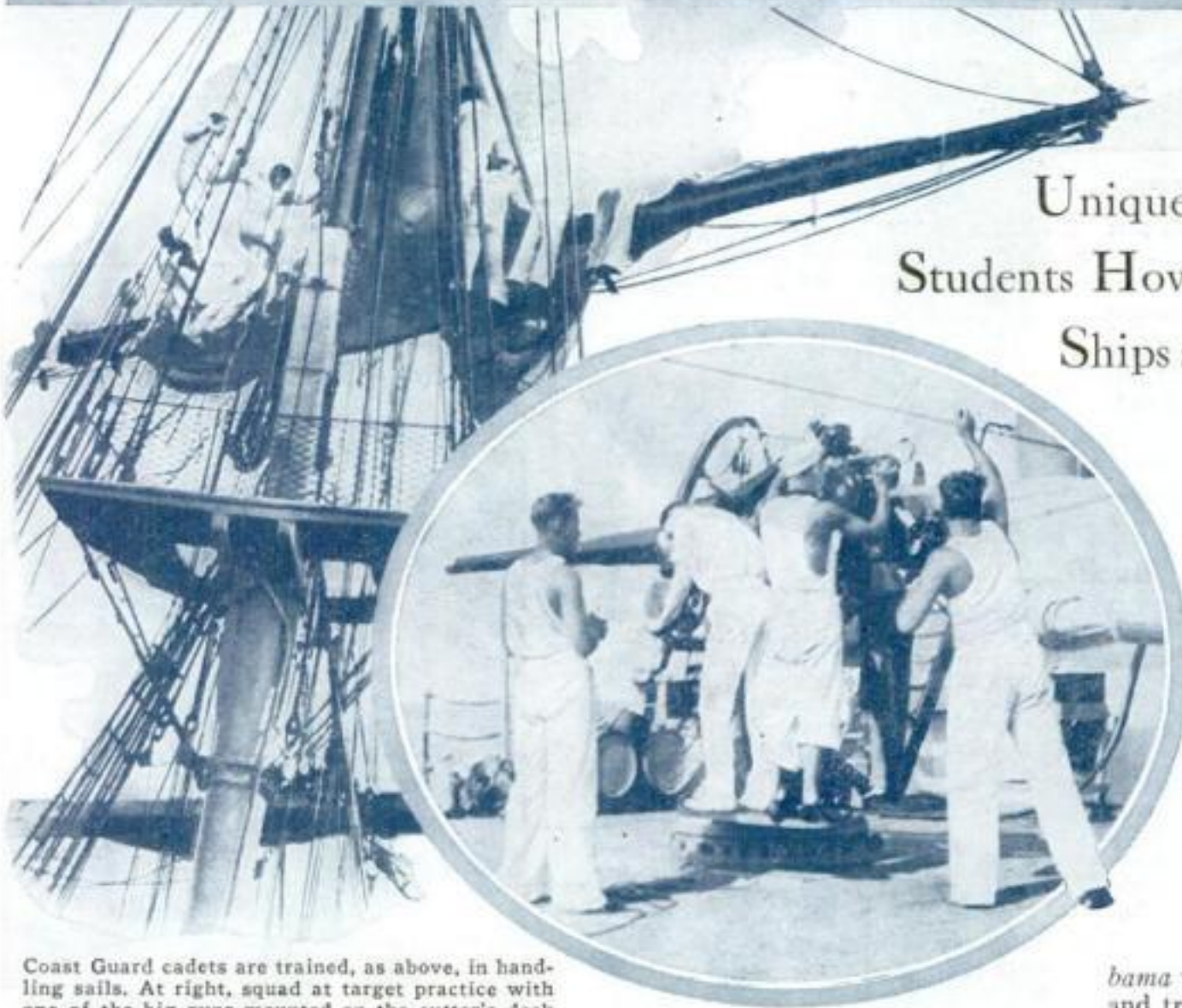
Although it costs nothing to get the four years of training in the Coast Guard Academy, the requirements are rigid. To be eligible for admission you must be an American citizen, between the ages of eighteen and twenty-two, unmarried, physically sound, constitutionally strong, and





Patrol Boat *Thetis*, newest vessel of the Coast Guard fleet. It is on a ship like this that the boys go on voyages and learn the duties of navigating a vessel

## Unique School Teaches Its Students How to Rescue Disabled Ships and Trail Smugglers



Coast Guard cadets are trained, as above, in handling sails. At right, squad at target practice with one of the big guns mounted on the cutter's deck

have a high-school education and at least a year in college. Possessing these qualifications, you must pass an examination in history, mathematics, and English. Not the easiest of all, you must finally convince the examining board that you have those qualities of character and manliness that would make a good officer.

Examinations are usually held during the middle of June, and in most of the large cities of the country. If you are appointed as a cadet, your transportation will be paid to New London. But do not be overly disheartened if you are not. Only fifty-one of more than 800 applicants who took the examination last spring passed. The Academy was really anxious to obtain about sixty.

To many, the Coast Guard is a child of the rum-running war. Actually, under the name of the Revenue Cutter Service, it is nearly 150 years old. Alexander Hamilton and George Washington were its first sponsors. An Act of Congress in 1790, brought it into being to suppress pirates and smugglers.

At that time, merchantmen of the United States were being harried by privateers of France and England. Against these men-o'-war was sent a small fleet of cutters, the largest carrying seventy men and fourteen guns. Urged on by the indomitable crews of the new service, these little vessels captured prize after prize, and finally succeeded in driving the marauders from our seas.

What officer of the service cannot recall the thrilling record rolled up by the cutter *Pickering*, during the difficulties with France in 1799? In times when fighting consisted of broadside against broadside, ten enemy ships went down before her guns and crew, one of them a frigate of forty-four guns and 200 men!

It was the Revenue Cutter Service that fought the bloody battles with the pirates of the Spanish Main. When Jean La Farge, ex-lieutenant of the notorious Jean La Fitte, attacked the cutters *Louisiana* and *Alabama* with his powerful pirate ship *Bravo* and tried to force them to accept defeat, he was due for the surprise of his life. Suddenly becoming the aggressors, the dauntless cutter men boarded their pirate captor, carried her decks in a furious hand to hand fight, and hauled down the Jolly Roger of her cut-throat crew!

Such thrilling episodes marked the beginning of a service that during its entire history has been characterized by exploits of heroism and daring. In every war but one in which the United States has participated and in its battles to save lives and ships from the sea, the Coast Guard has steadily added distinction to its traditions.

Some of the most arduous battles of this strange peace-time navy of the Treasury Department are still with the smuggler. Today the rum-runner predominates, but the alien and *(Continued on page 92)*



# ENTIRE CITY *takes part in* Great Sham Air Raid

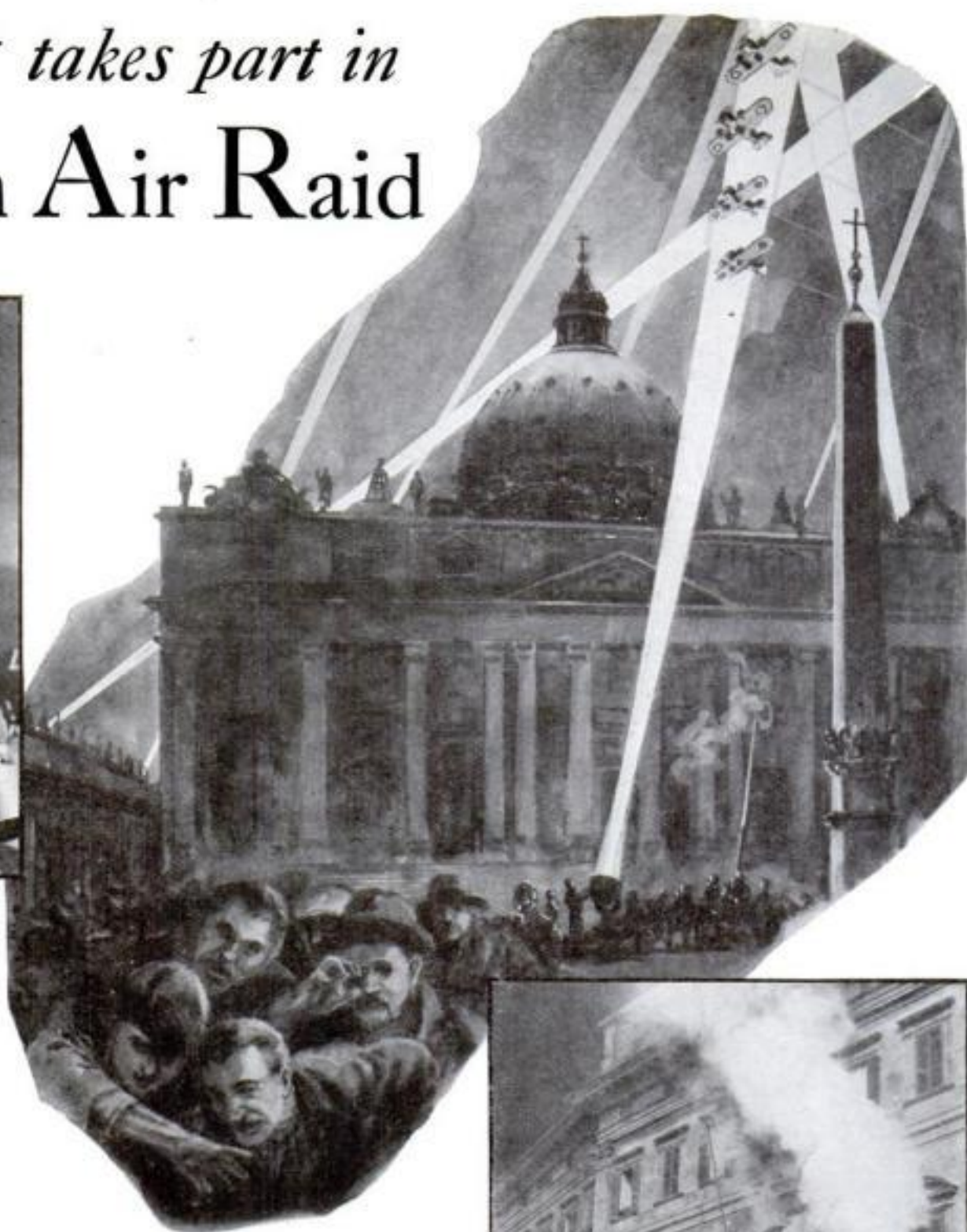


Fire fighters, wearing gas masks, extinguished fake flames during an air raid rehearsal in which all the citizens of Rome took part

**W**HEN Italian airplanes roared over the city of Rome in a series of three mimic air raids a few weeks ago, the half-million inhabitants did not remain on the sidelines as spectators. By Government edict, the civilian population participated in the unusual rehearsal. The result was a giant show so impressive that many thought war actually had been declared.

Shortly after ten o'clock one evening, the whine of sirens and the tattoo of anti-aircraft guns announced that bombing planes of the "invaders" were approaching the city. Street lamps went out, the city was darkened to hide its landmarks, and searchlights explored the skies for the raiders.

At one of the busiest street intersections, an officer halted all traffic. Private cars and buses were ordered to the curb. A trolley stood stalled on its tracks. Policemen hurried the passengers out of their vehicles and bundled them into doorways for shelter. Buildings had been ordered to remain open all night for the purpose. Throngs also crowded into the big pedestrian tunnel between the Via Nazionale and the Via Tritone. The crowds had not long to wait before the bombers appeared. Concussions shook the air. Dummy incendiary and gas bombs were dropping from the planes—actually harmless, but exploding high above the buildings with realistic detonations. Thousands, peeking from their shelters, saw ambulances, dispatch riders, and fire engines rush through the cleared streets. Smoke pots had been set in public buildings at strategic points to simulate real fires, and the firemen dutifully "extinguished" them. Stretcher bearers in gas masks picked up "gassed civilians" and carried them to the ambulances. The



## CITIZENS HELPED AIR RAID

Drawing above suggests how frightened residents of Rome were herded into shelters during sham air raid. At right, firemen fight "flames" started by fake bomb. Below, citizens of suburb near Rome dressed and equipped to fight during an aerial attack that dropped fake gas bombs



alarms were repeated several times as the aircraft passed over the city.

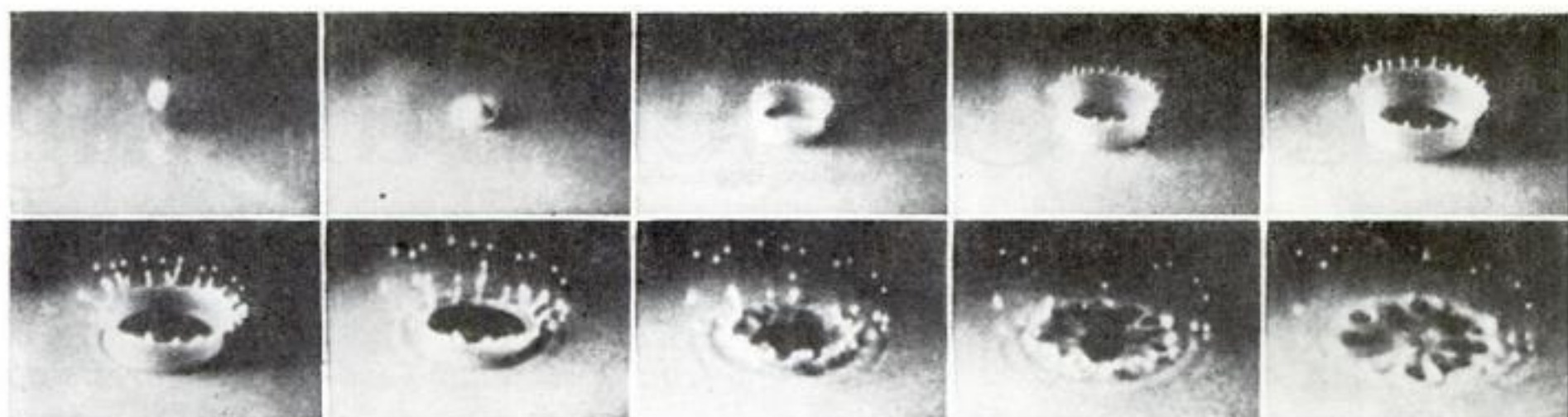
No sooner had the airplanes withdrawn than crews were on the streets with chemical sprayers to clear away the last traces of the imaginary poison gas.

The object of the mimic raids was to train the populace in protecting themselves against an air attack. Also the government pointed out that the raids will



make all citizens realize the horrors of war as fought with the deadly modern weapons. Rome, like many European centers, is making practical preparations for possible aerial invasion. Tunnels for a new electric railroad entering the city are being constructed with built-in shelters for refugees fleeing an air raid.





With an exposure time of less than one hundred-thousandth of a second, these pictures of a falling drop of milk were made at the Massachusetts Institute of Technology. Note the crown shape, which becomes more marked as the drop strikes a hard surface. Pearl-like droplets tip the crown points

# Dazzling Spark *takes* Fastest Photos



## QUICK AS A WINK.

From top to bottom, these photographs, taken at the rate of 500 a second, show the closing of an eyelid. This new circuit method of taking pictures proves wink takes one-fortieth of a second

**P**HOTOGRAPHS at the rate of 4,000 a second, with exposures ranging from  $1/100,000$  to  $1/500,000$  of a second, have been made at the Massachusetts Institute of Technology by means of an electrical circuit that produce light of great actinic intensity. The instantaneous flash is many times more brilliant than sunlight.

The misshapen figure of a golf ball in flight has been recorded by means of this latest development in high speed photography.

The new circuit, employing either mercury arc tubes or spark gaps, was developed by Professor Harold E. Edgerton and Kenneth J. Germeshausen of the electrical engineering department. By means of this circuit it is possible to make both still and motion pictures. For the latter, special cameras are necessary.

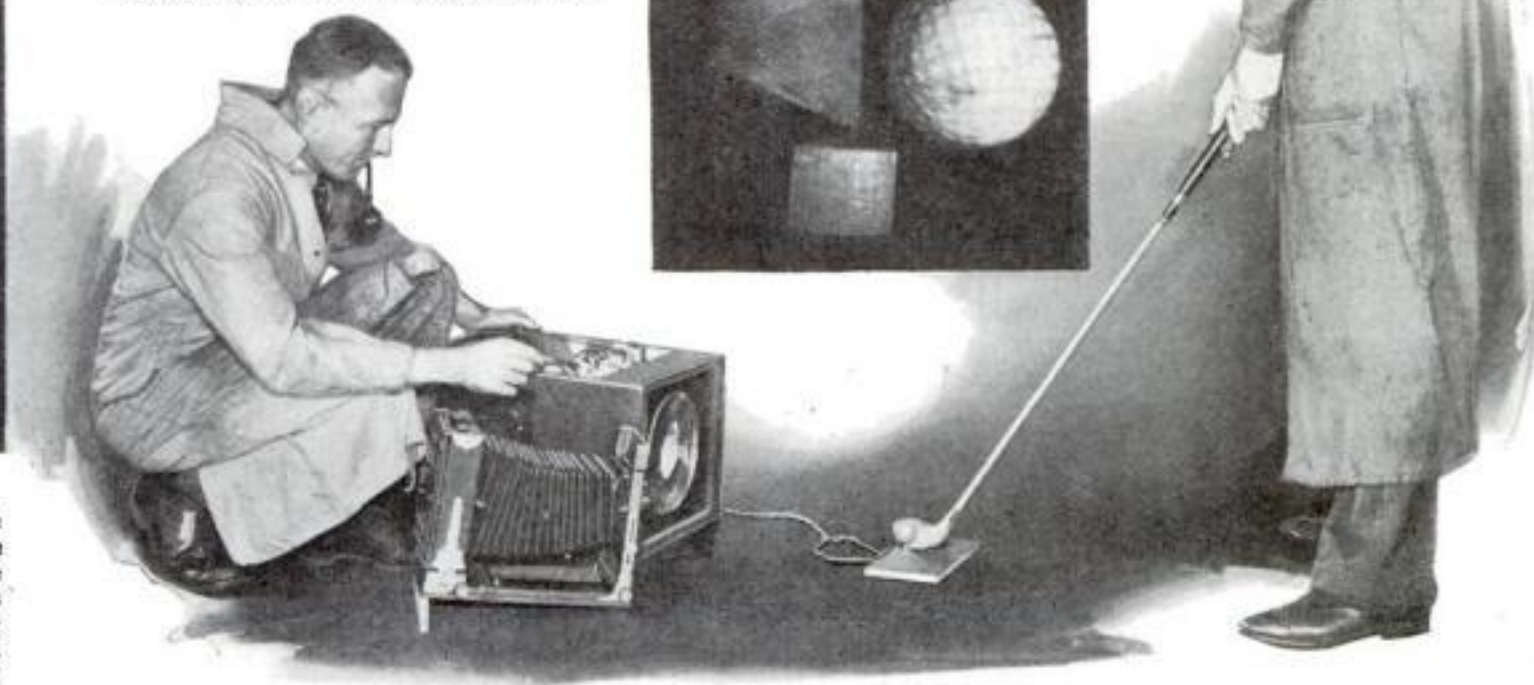
The light produced by the new circuit occurs in pulses or flashes, and the intensity of each flash is equal to the concentrated light of approximately 40,000 ordinary fifty-watt bulbs—brighter than the noonday sun. The scientific importance of the method lies in the fact that the frequency of the flashes or the moment of starting may be controlled.

**FLAT GOLF BALL.** Flash pictures, made as illustrated below with the impact of club on ball compressing wires and closing circuit, show how ball, flattened when hit, regains spherical shape

In making motion pictures, the pulse of light is synchronized with the speed of the film which moves past the lens aperture at velocities up to 200 miles an hour.

The light has already been used to make photographs in which familiar things are shown in astonishing new forms. The splash of a drop of milk on a hard surface is revealed in the shape of a miniature crown tipped with infinitesimal pearl-like drops. Photographs of the human eye show that a wink occurs in approximately one-fortieth of a second. Picture of golf club hitting ball shows a most surprising flattening of the ball at the point of contact.

The chief feature of this circuit consists of mercury arc tubes which are made to produce intense flashes of a bluish-white light.





# Big Game Hunting

*YOUR glass reveals queer creatures that live in a drop of water taken from a stagnant pond—Dense forests appear in the green mold of stale bread and fungi wave their strange lace-like tendrils*

## DISSECTING MICROSCOPE

A fairly powerful pocket lens is mounted as shown at the left above a mirror that is set at exactly forty-five degrees. The glass table top is held in place with tiny brads and it is on this table that specimens are dissected



**F**ITTED out with the baggage I described last month, we are ready for our first journey into that strange world revealed by a microscope of reasonably high power.

Our first sight-seeing tour leads us through a growth of fungus—a weird forest that we will cultivate on a slice of whole wheat bread.

To grow this forest we simply place a piece of the bread in a damp spot in the cellar for a day or so. We shall soon find on its surface a delicate greenish gray growth, one of the common molds, nature's most delicate vegetation. By the careful use of our little scalpel and needles mounted with handles (P.S.M., Dec. '32, p. 52), we separate a tiny speck of this material and place it on the surface of a glass slide. This we must do with patient fingers for we cannot afford to crush the delicate plants. Then, too, we must see to it that the specimen we take is so thin light will pass through it. A piece a little larger than a pin head will be plenty.

After it is placed on the stage of the microscope, we adjust the light until we secure an even field of illumination, not so bright that it will cause eye strain and not so dull that it will rob one of the view. Following the directions given last month, we then adjust the objective until it is about three-eighths to a half inch above the specimen and focus UPWARD. Presto! we enter the land of mold.

Mold is a common, unscientific name for fungi and what we gaze at really is a microscopic form of mushrooms or toad-

stools. These tiny plants present themselves like great bushes of fine fuzz. We may find many other interesting examples of fungi on old cheese, plants, and the bark of trees.

On our next excursion, we come to the first great adventure for every embryo microscopist: the examination of the life from a stagnant pool of water. If we obtain the right kind of water, the fleeting life that will sweep past our vision will make the traffic of a metropolis seem dull, indeed.

The professionals use special apparatus to collect aquatic life, but we can afford no such luxuries. So we take a wide-mouthed bottle or jar and attach to it a heavy piece of cord. A pint mayonnaise jar will be suitable. Stagnant pools of water can always be found near the city. The bottle is dropped to the bottom of the pool and dragged across the soft, muddy bottom. The experimenter should



## ODD WATER CREATURES

With a microscope, you can see in a drop of stagnant water, the water fleas, left, and the cyclops above. Note several female cyclops with egg bags. Male is near edge of circle

Photomicrographs from New York Biological Supply Co.



**THIS IS THE FOREST PRIMEVAL**  
Looking at the green mold on stale bread, you will see a forest like this, with swaying tendrils



# with a MICROSCOPE

By  
BORDEN HALL

be sure to gather in some of the bottom mud for in it we shall find the most interesting animals.

Naturally, in the examination of this welter of life, both vegetable and animal, we shall have to take things as they come for we are dealing with the tiny life of the sub-world. It will not be long, however, before we come upon those lively creatures, the water fleas, both male and female, although the latter will greatly outnumber the former. We proceed by taking a small sample of water from the jar with a medicine dropper and placing a drop or two upon a glass slide. This is brought to focus under the objective,

leaving the tube of the microscope in a vertical position so the water will not run off and carry the specimens away.

The water flea is recognized by its jerky method of swimming. It uses anything but the Australian crawl. We shall not need a powerful objective for this crustacean for, full grown, it is one-sixteenth of an inch long. Indeed, nature has provided it with some pretty decent equipment.

If we watch closely we shall find that it has a head, a compound eye, feathery antennae, mandibles, and a tail. If our light is good, we shall be able to see the whole interior of the little flea. The beating heart will be visible as well as the digestive organs. If we are watchful, we will find a female with undeveloped eggs in the back of her body.

Sooner or later, we shall come upon a creature named for the mythical giant, Cyclops. Here is another crustacean that ambles jerkily through the watery lanes. He is a formidable appearing creature, with a single eye in the center of his flat head, a pear-shaped body, and a spike-like tail. Like the flea, he is provided with antennae, but he has five pairs of legs. The females may be distinguished by the bags of eggs they carry on either side of their bodies.

In our exploration of these lively scenes, eventually we come upon a little creature that is a sort of primer

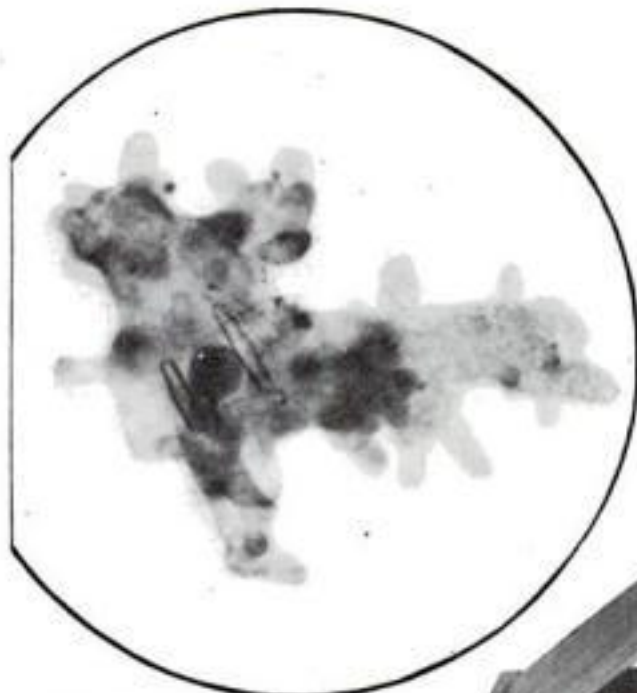
of life, a simplified edition of all living things. This is the amœba. It abounds in the mud and decaying vegetable matter at the bottom of pools and ponds. It measures about one-ninetieth of an inch but unfortunately we cannot describe an amœba exactly. The best we can do is to say that it is a tiny mass of protoplasm of no definite shape but capable of assuming many different forms.

The amœba has no organs. With its slimy little body, it can make projections that serve as hands or feet. When it is hungry, it wraps its whole body about its victim and absorbs it. It digests without a stomach, walks without hands or feet, and without a trace of a nervous system, it responds to stimuli. We shall indeed be fortunate if we can observe the birth of an amœba, the simple trick of a creature tearing itself in half to make two.

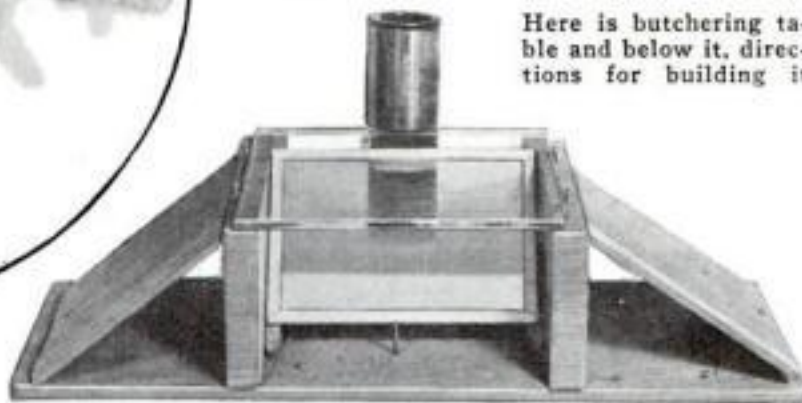
Interesting as the amœba is, we shall have to leave it to seek other wonders. For speed and prowess, we take our hats off to the polyzoons, the playboys of pond life. These tiny things, of which there are a number of varieties, live in colonies and are usually attached to the roots of aquatic plants. The polyps have strong family ties for they are found bound together with a sort of mucilage that assumes a shape like the mouth of a wine glass while in the water.

The little imps in this strange habitation are exceedingly beautiful and when actively feeding, we see them extending their delicate tentacles into the surrounding area with a lacy, wave-like motion. In so performing, they create a tiny vortex that draws their food into their mouths.

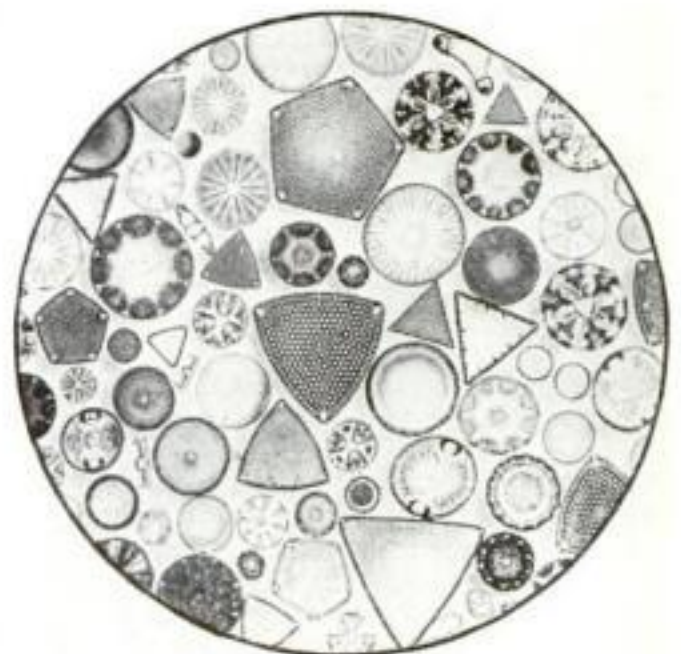
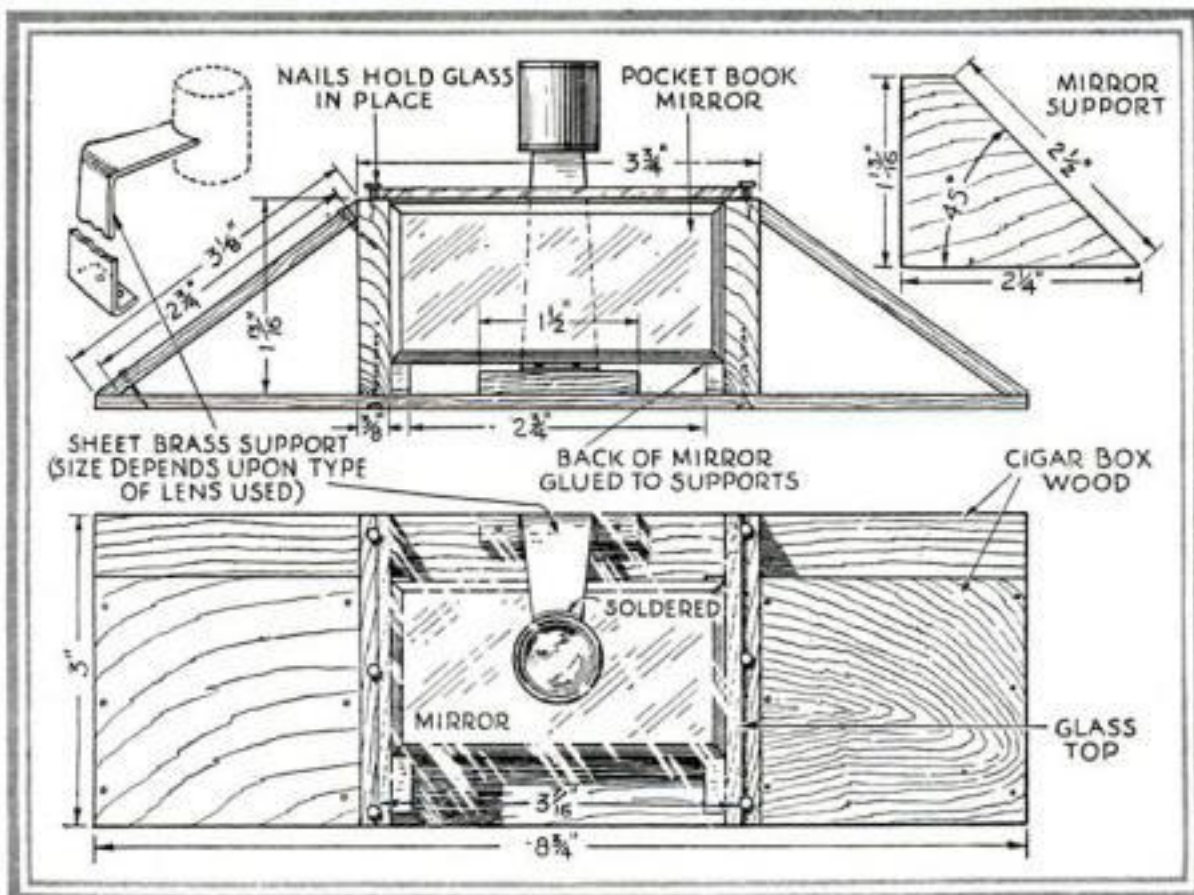
Then there are the rotifers, or "wheel-bearers." We may find them swimming carelessly about or in their idle moments, attached to some sort of marine vegetation. We note the sucker-like foot, the transparent body, and the two disks at the head. Examining these disks, we discover where the creature gets its name for we see they are edged with fine lashes called cilia, which wave with such uniformity that one *(Continued on page 85)*



FIRST LIFE FORM. Your glass will show amœbas, the simplest of all animal forms



Here is butchering table and below it, directions for building it



WHERE ARTISTS GET IDEAS

Diatoms are tiny plants that are found, as picture shows, in many different designs

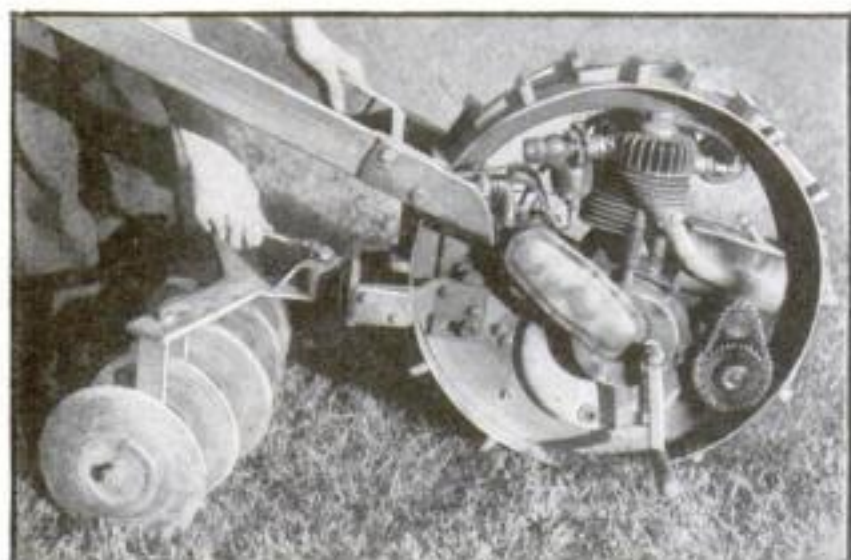


# Homemade Tractor Has One Wheel

WITH a power plant that is suspended securely inside of a big ring-shaped wheel, a garden tractor has been built largely from odds and ends by R. D. Read of Akron, Ohio. It operates like the unicycle automobile developed in England. (P.S.M. May, '32, p. 63.) A single-cylinder motorcycle engine was used without modification except for the installation of an additional gear for cranking, and a planetary type clutch operated from the plow handle. The wheel is of sheet steel. T-shaped lugs stud its outside surface to give the tractor a firm grip. Around the center of its inside surface is a steel ring of square cross-section, having steel pins running through it to form a rack in which the teeth of a straddle gear engage. This gear is driven by a chain from the planetary clutch. Each handle of the plow-tractor is hollow, being made from chan-



Handle on right of tractor holds gasoline and photo above shows it being filled. Left handle holds the oil



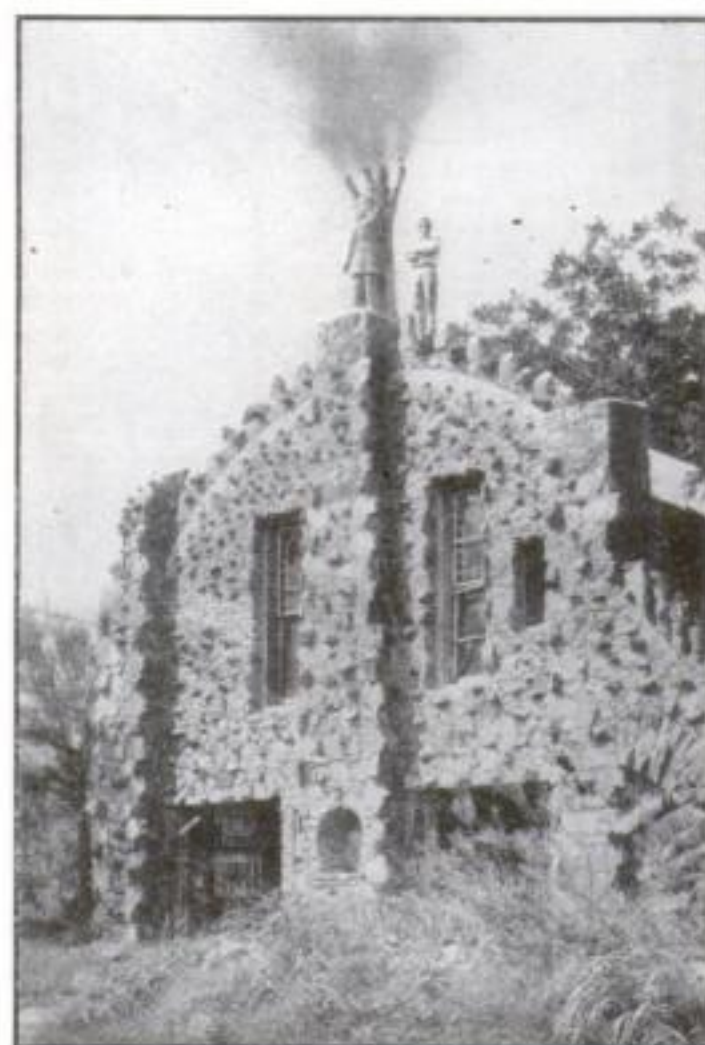
Above, tractor with engine inside its one wheel has plow attached and photo at left shows the tractor pulling a disk harrow. The machine, made of odds and ends, will run for more than eight hours on one gallon of gasoline



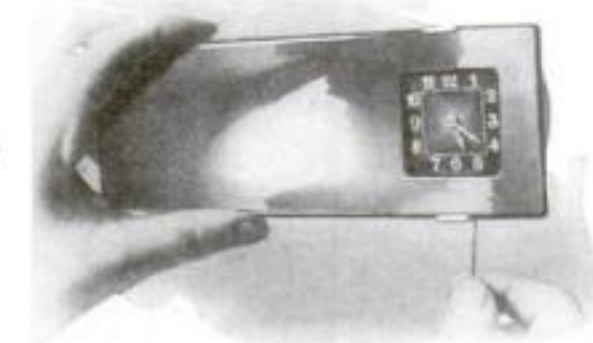
nel-iron stock. One handle carries gasoline and the other oil. Controls are near each handle grip. To a coupling at the rear practically any farm tool can be attached. The tractor with a four horsepower motor, will run for eight hours, as fast as a man can walk, on a gallon of gasoline.

## TREE-LIKE CHIMNEY ON STONE HOUSE

STONE of many kinds is going into a house being built by Mrs. F. E. Routledge of San Antonio, Texas. Not yet completed, after three years of labor, the house already has become one of the city's attractions. One of its unusual features is a chimney in the shape of a tree with branches through which smoke escapes. A carved figure of a huge snake in combat with an eagle adorns one side of the rock house. The building is to be used as an apartment and studio.



House built of many kinds of stone at San Antonio, Texas, has tree-like chimney with several branches, through each one of which the smoke easily escapes

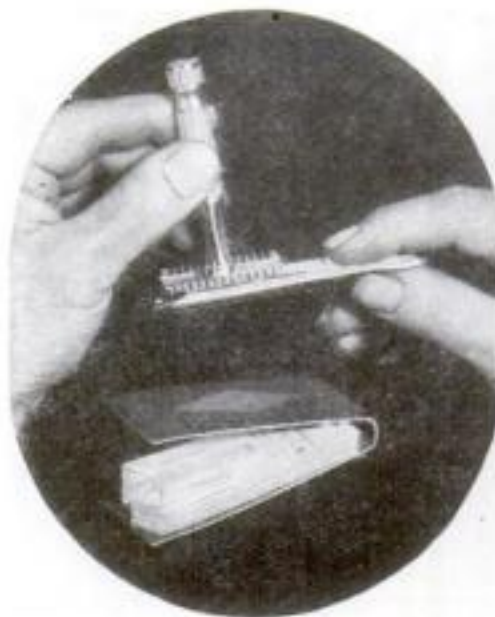


## REAR VIEW MIRROR AND AUTO CLOCK COMBINED

CLOCK and rear view mirror are combined in a new accessory for motorists. A few pulls of a small cable beneath the timepiece wind it. Thus a driver can wind it without slackening speed or taking his eyes off the road.

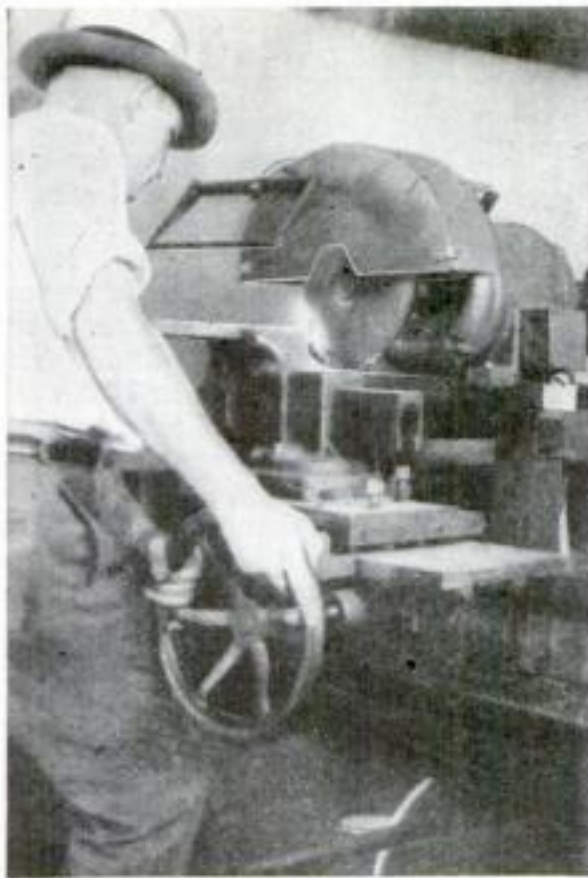
## PAPER SHEETS FOLDED TO DRY RAZOR BLADE

SAFETY razor blades can be dried and cleaned without taking the razor apart by means of paper driers recently put on the market in France. The absorbent papers are cut and folded so they slip over the blades between the loosened guards and can be moved back and forth to dry the blade. The driers come in small booklets from which the sheets are easily torn.



Folded paper sheets used to dry razor





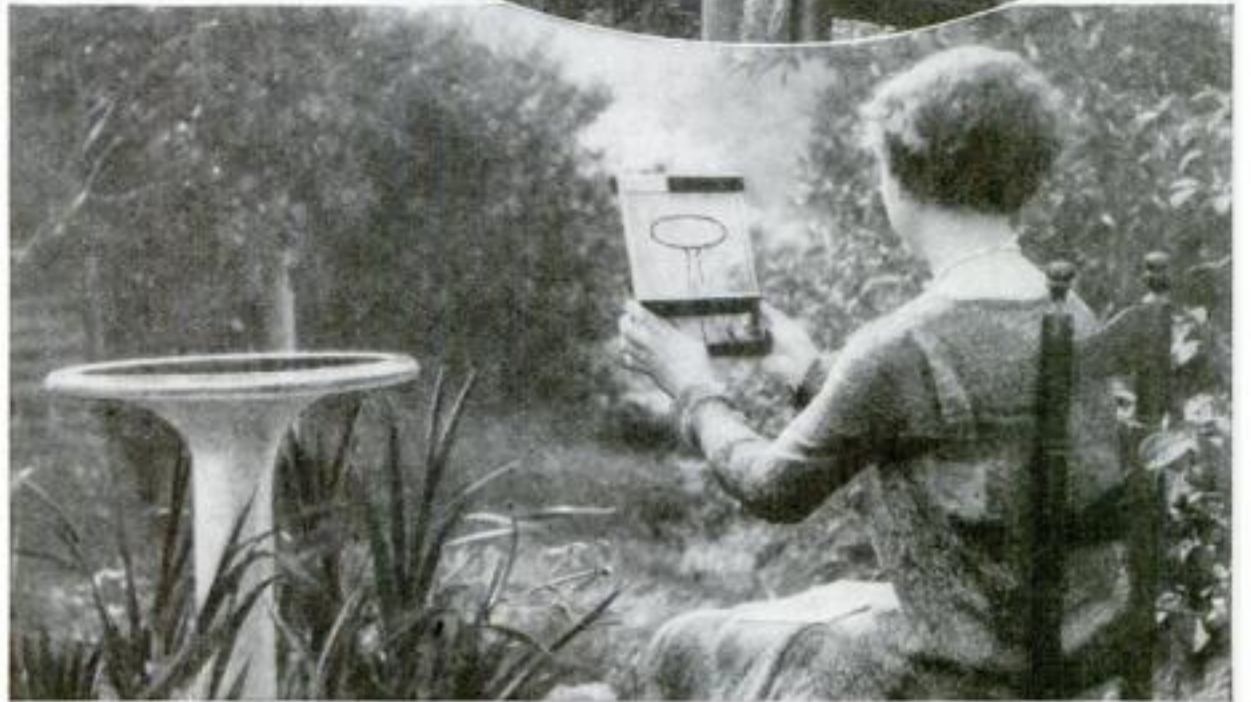
### ELECTRIC SAW BURNS THROUGH STEEL BAR

REVOLVING rapidly, a new electric saw will burn its way through ten inches of solid steel. Its cutting tool is a smooth disk made of special heat treated steel, rotated by an electric motor. The bar to be cut is clamped in a movable vise and one side of the secondary of a special transformer is connected to it. The other terminal of the transformer connects to the rotating disk. When the bar is moved against the disk, an electric arc melts away the bar.

## DRAWING GLASS TEACHES ART AT HOME

In using the drawing glass, right, the student first sketches the subject, here a bird bath, on glass as nearly like original as possible

After the student finishes, the white card is removed, below, and the transparent sketch is compared with original so errors may be checked



### KEY RING ON SPRING REEL

TO KEEP keys handy, a new spring reel for a man's belt has been designed. The reel unwinds when a key is pulled out for use, as illustrated. When released, the spring snaps the keys back into place.



A NEW vision-training device called a "drawing glass" quickly teaches children or other beginners to draw and paint, according to Anson K. Cross, art instructor of Boothbay Harbor, Maine, who perfected it. The drawing glass consists of a common window pane, backed with a removable white card, set in a frame with a spirit level. The student first tries sketching an object from nature upon the backed glass, using special crayons. Glancing from subject to sketch, he corrects the latter until he thinks it perfect. Then he removes the card and sights through the transparent sketch at the subject, moving the

sketch until the outlines match. Errors are revealed at a glance. The sketch is erased and other attempts made, until repeated practice gives the student mastery at judging form. Two lenses in the base of the device train his color perception by blurring details of the picture and enabling large masses of color to be recognized. The inventor says that an amateur using the drawing glass in his home soon acquires a proficiency that would customarily require personal instruction from expert teachers, followed by a long period of training and patient practice by even the most talented students.

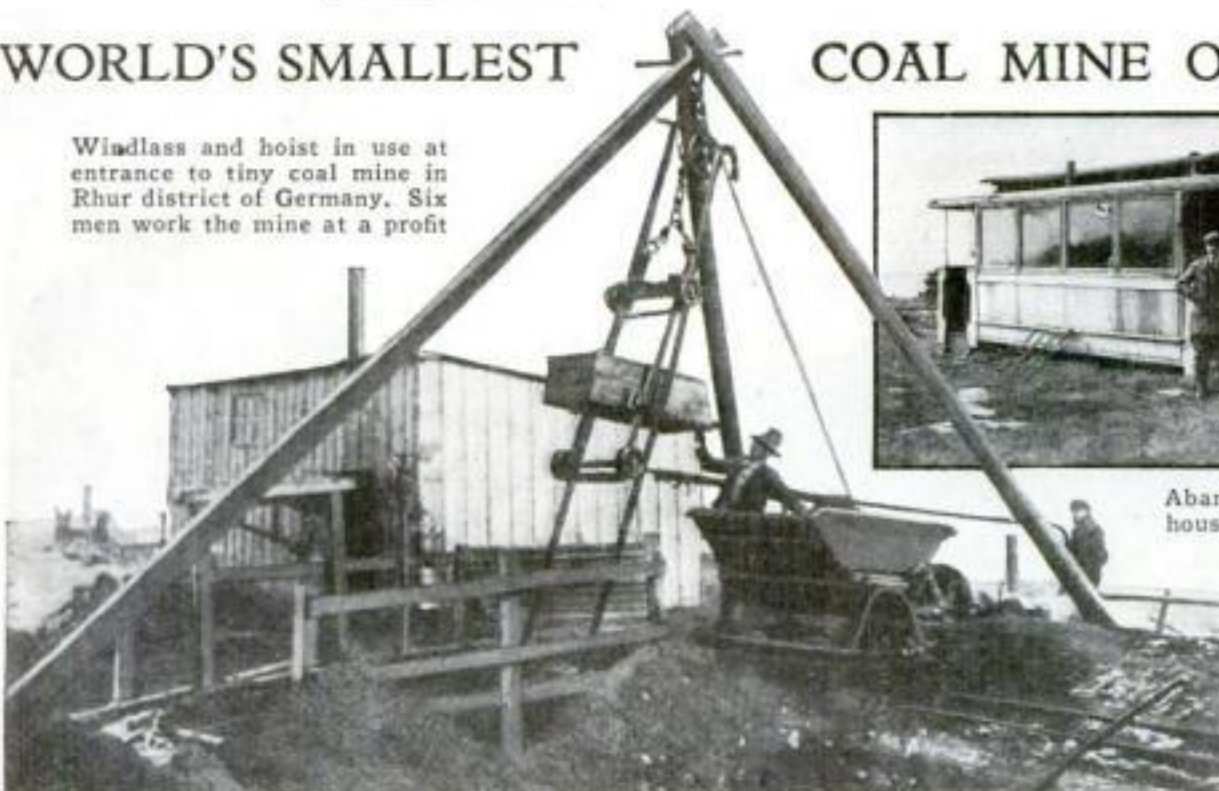
## WORLD'S SMALLEST

## COAL MINE OPERATED BY SIX MEN

Windlass and hoist in use at entrance to tiny coal mine in Rhur district of Germany. Six men work the mine at a profit



Abandoned streetcar houses mine's office

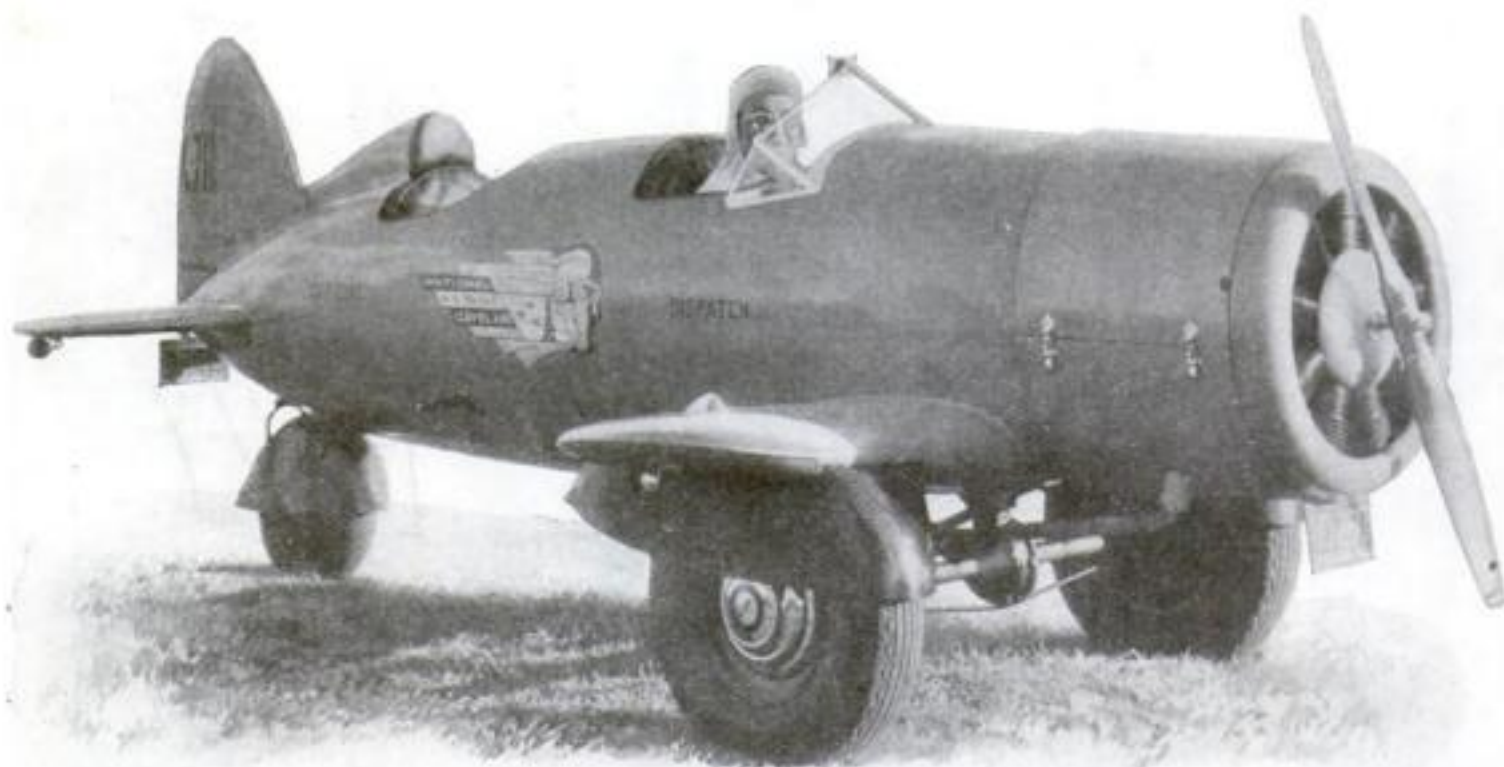


WITH an abandoned streetcar for its office, what is said to be the smallest coal mine in the world is operating at a profit in the Rhur district of Germany. It was started four and a half years ago by six unemployed miners. An ancient locomotive, two tiny cars, a second-hand air compressor, a windlass, and a winch was their entire equipment in attacking the vein of coal which was so small that

no one had ever tried to commercialize it. Three members of the company work underground. Two handle the coal at the surface, while the sixth attends to selling and shipping the product. The vest pocket mine has reported a small profit for each of the years it has been worked.



# Three-Wheeled Auto Looks Like An Airplane



WITH wings for fenders and a streamlined metal body that resembles an airplane fuselage, a three-wheeled, front-drive automobile recently underwent tests at Indianapolis, Ind. The auto-plane, said to be capable of seventy-mile-an-hour speeds along a highway, is the invention of Grover E. Olds, an aviator. Steered by the "caster" wheel at the rear, the fifteen-foot-long machine can turn in a radius of fourteen feet. A four-cylinder, seven-horsepower motor within the body turns the front wheels. The two passengers sit in cockpits.

## FILLING STATION OPENED FOR PLANES

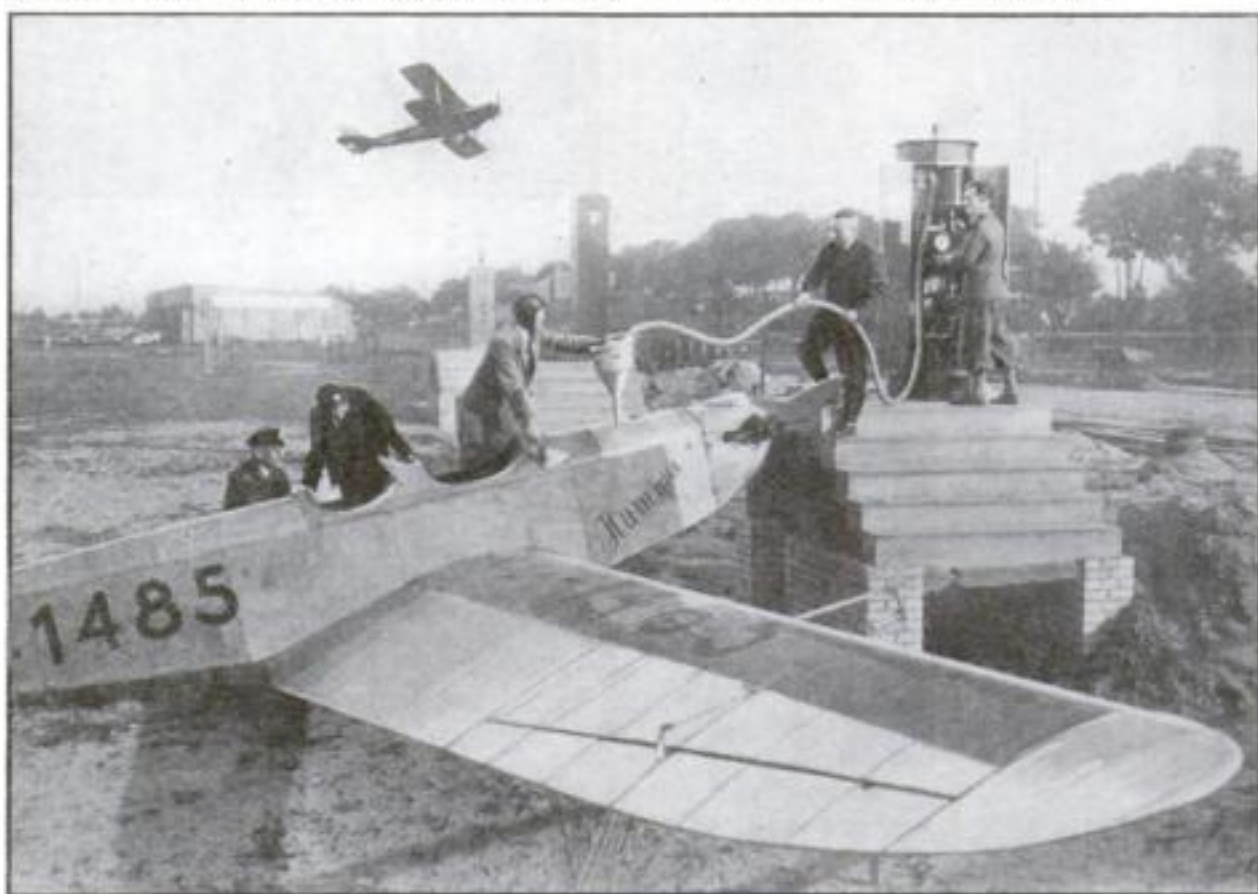
PILOTS of light airplanes may now taxi up to a row of gasoline pumps, choose their favorite brand, and tell the attendant to "fill 'er up." The picture below shows a filling station for sport aircraft recently

opened near a Berlin, Germany, air field. A featherweight craft of the powered glider type is fueling up. A good-sized funnel insures that the gas will go where it is wanted without spilling.



## ELECTRIC CUTTING TORCH CAN VAPORIZE DIAMONDS

HOT enough to vaporize diamonds or to melt tungsten is the arc of a new electric cutting and welding torch, designed by a Los Angeles, Calif., engineer. Twin electrodes in a special mounting enable it to form its own arc, independently of the material to which it is applied, as shown in the photograph above. The temperature attained is about 6,500 degrees F.



Light sport aircraft taking on gas at filling station for planes near Berlin

## MATCH CAN BE LIGHTED 100 TIMES

IF YOU borrow a match from the gentleman pictured at the right, he is likely to want it back! He is one of the users of a new repeating match recently produced in England. The match may be struck and re-lighted more than a hundred times. A small box, coated with a special composition used as the striking surface, serves as a holder for the repeating match when it is not in use. The device is much thicker than an ordinary parlor match and gives a correspondingly larger flame.



## BURNED OUT BULB GLOWS

WHEN a string of miniature low-voltage lamps of a new type for Christmas tree and ornamental use goes out, a telltale glow appears in the one that caused the trouble. A burnout impresses full voltage across the lamp terminals, causing a small quantity of neon gas in the bulb to glow. This is visible through a window of clear glass near the base of the bulb.



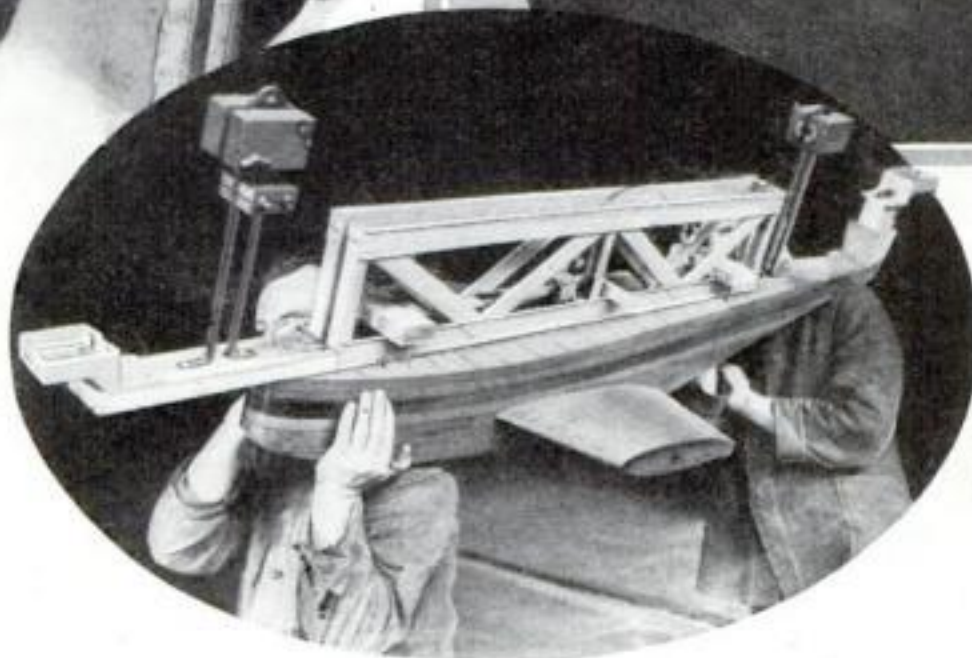


# Wax Models Test Big Ocean Liners

Into these concrete molds, hot paraffin is poured and an exact reproduction, on a small scale, of an ocean liner's hull is cast. These models are then used to test the sea-going qualities of the proposed ship. The tests are of recent origin



**P**ARAFFIN models are being used to test the seaworthiness of huge liners, before they are built, in a kindergarten for ocean giants, in Berlin, Germany. In the laboratory, officially known as the Prussian Ship-building Experiment Station, workers pour hot paraffin into carefully-prepared concrete molds. These molds, some of them more than a dozen feet long, reproduce, exactly to scale, the dimensions of the proposed vessel. Before the white, wax-like models are placed in the testing tanks, they are given a number and gone over with a special apparatus that seals all leaks. Then the tests begin. Cameras snap pictures, automatic instruments record data, experts jot down notes as the em-



This wax model of a liner's hull has been removed from mold and is being lowered into the laboratory's tank where tests are made

Model of a seaplane, left, with instruments in place to record data of use to the designers working in the Berlin laboratory

bryo liners buck six-inch waves and artificial winds on the water of the testing tank.

The results furnish valuable information about the characteristics of a liner months before even the keel is laid. Addi-

tional tests show how the design reacts to propellers and rudders of various kinds. At the end of the experiments, the inexpensive paraffin model can be melted up and used to reproduce another greyhound of the sea. Besides the work in testing ship designs, the experts at this laboratory are using paraffin models in an extensive investigation of the characteristics of various types of German seaplane floats and flying boat hulls.

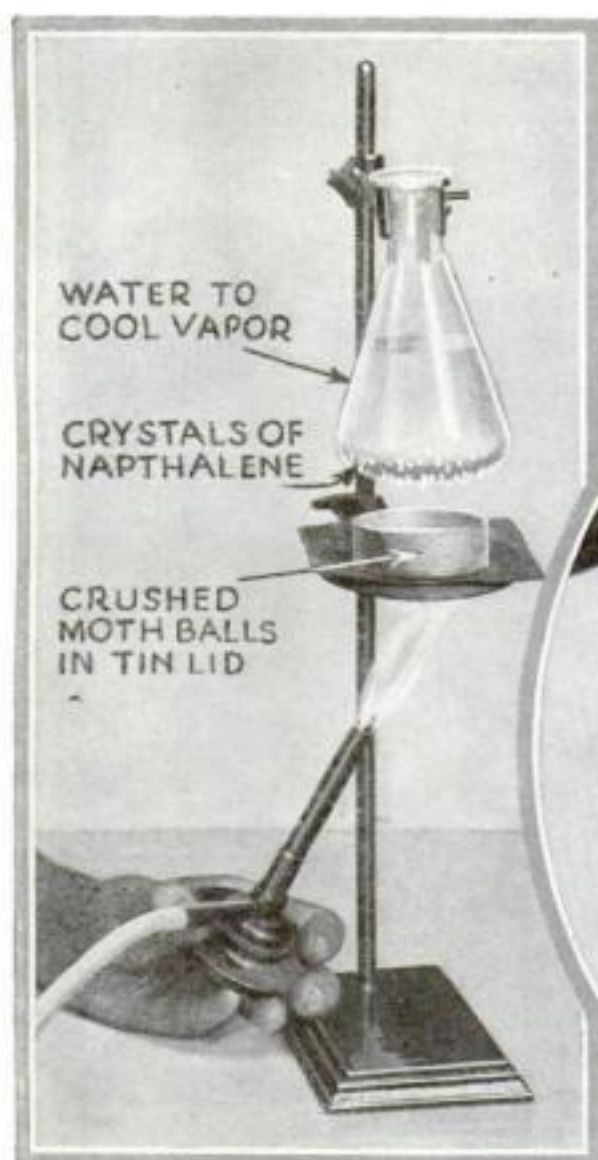
## BIRD-EATING SPIDER CAPTURED FOR NEW YORK ZOO



A HUGE black spider, whose outstretched legs and hairy body would cover half this page, was added recently to the collection in the reptile house of the New York Zoological Park, New York City. It was named Black Beauty by its captor, Raymond L. Ditmars, curator of reptiles and mammals. It is a relative of the tarantula and is known as the bird spider in its native Central and South American countries because it often captures and devours small birds. It lives in holes and under logs, spins no webs, and hunts only at night. Sometimes, the hair-covered bodies of these giant arachnids are said to measure seven inches in length with legs nearly as long.



# Home Chemists Can Make These Interesting Experiments with



With this apparatus, and a small quantity of water and crushed moth balls, glistening, flaky crystals of naphthalene can be made with little effort in your home laboratory



## HOW TO COOL LIQUIDS WITHOUT USING ICE

On a block of wood pour a few drops of water and in this puddle set a beaker half full of water. Pour ammonium nitrate into the beaker and stir vigorously. In a minute or two, the water on the wood will freeze and, as shown in circle, the block will be frozen securely to the glass

**W**HEN you stir your morning coffee to dissolve the sugar, you are demonstrating an important property of solutions. Like all soluble substances, sugar dissolves more readily when each tiny particle is brought into direct contact with the liquid. Stirring does this by agitating the sugar and spreading it throughout the coffee.

Stirring, however, is only one means of making a substance dissolve more readily. Temperature also has a great deal to do with solubility. Hot coffee, for instance, will dissolve sugar faster than cold coffee. On the other hand, substances such as gypsum (calcium sulphate) and slaked lime (calcium hydroxide) dissolve more readily in cold water than they do in hot.

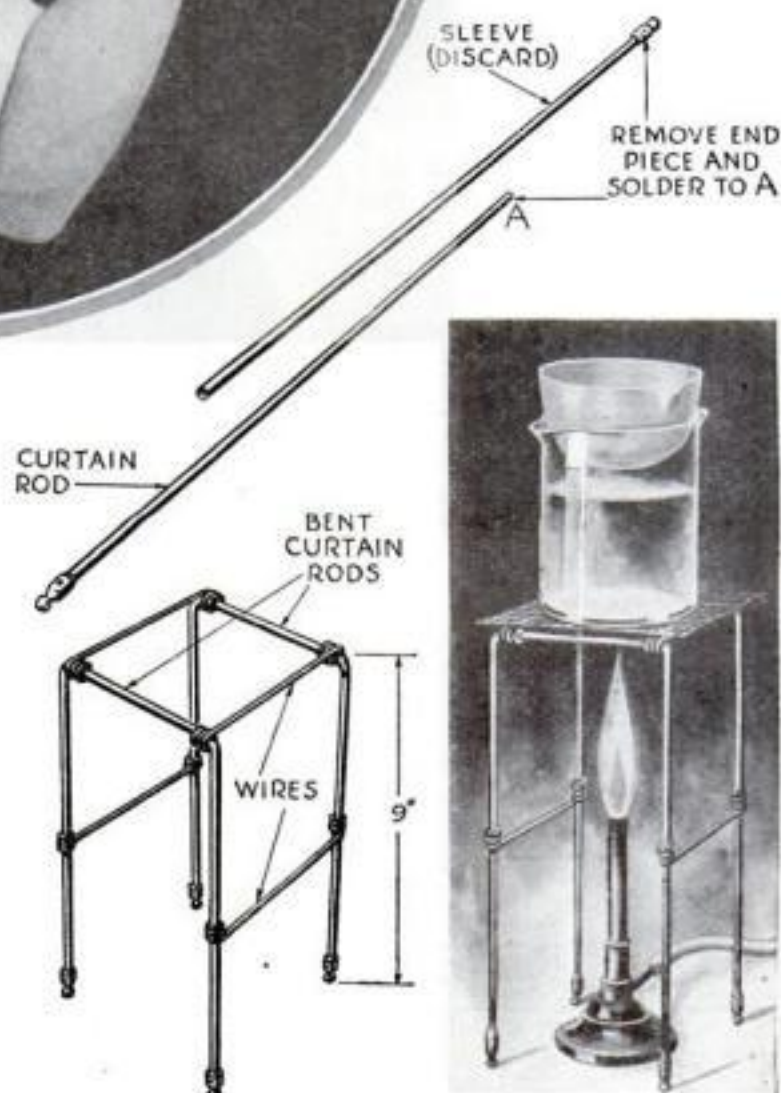
In many cases, heat is given off when certain substances are dissolved. Amateur chemists will recall the warning regarding the formation of heat when sulphuric acid and water are mixed. To be safe, the acid should always be poured into the water and the mixture stirred continuously to dissipate the heat. If the water is poured into the acid, it does not mix but floats on the acid and the heat formed where the two liquids meet will often generate enough steam to blow the water and some of the acid out of the container. Lime (calcium oxide) and lye (sodium hydroxide) also produce heat when they are dissolved in water.

Of course, many substances can be dis-

solved without affecting the temperature of the solution, while others absorb heat when they are mixed with water. Saltpeter (potassium nitrate), hypo (sodium thiosulphate), ammonium nitrate, and many other chemicals cause a marked drop in the temperature of water when they are dissolved. The home chemist can perform a striking experiment to show this action with a beaker of water, a block of wood, and a handful of ammonium nitrate.

Pour some water on the center of the wood block and set the beaker of water in the puddle that is formed. Then pour the ammonium nitrate into the beaker and stir it vigorously to dissolve all of the chemical. In a minute or so, the pool of water will be frozen so solidly that the wood block will stick fast to the bottom of the beaker. This absorbing of heat by certain dissolved chemicals was used centuries ago for cooling wines and food-stuffs.

The ammonium nitrate solution can then be set aside. As the water evaporates, the solid ammonium nitrate will crystallize out and can be used over and over again.



Pictures above show how support for beaker is made of bent curtain rods. At right, simple water bath consisting of beaker of water placed over Bunsen flame. Shallow dish on top of beaker contains solution to be evaporated

By means of the simple evaporating arrangement shown at lower right on this page, the amateur can hasten the evaporation and obtain the solid ammonium nitrate quickly.

The apparatus used is called a water bath. It consists of a beaker of water placed over a Bunsen flame and is similar to the double boiler used by the housewife



# SOLUTIONS

By RAYMOND B. WAILES

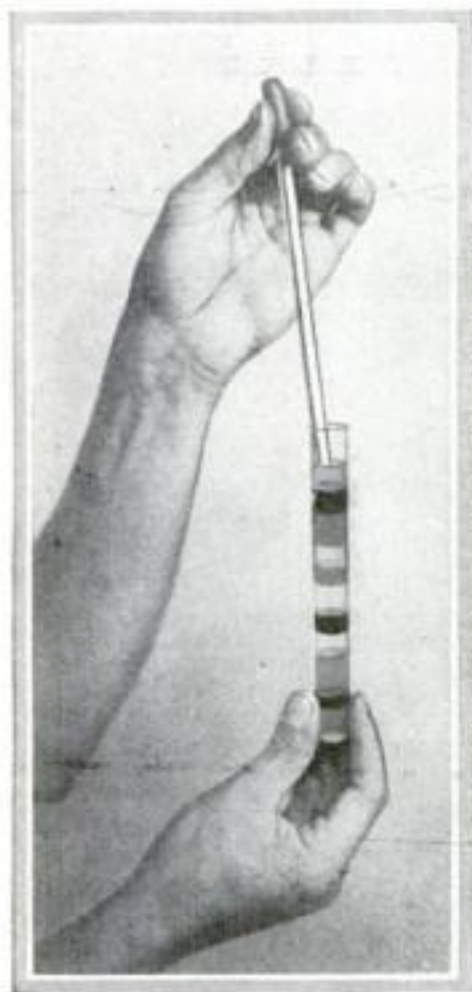
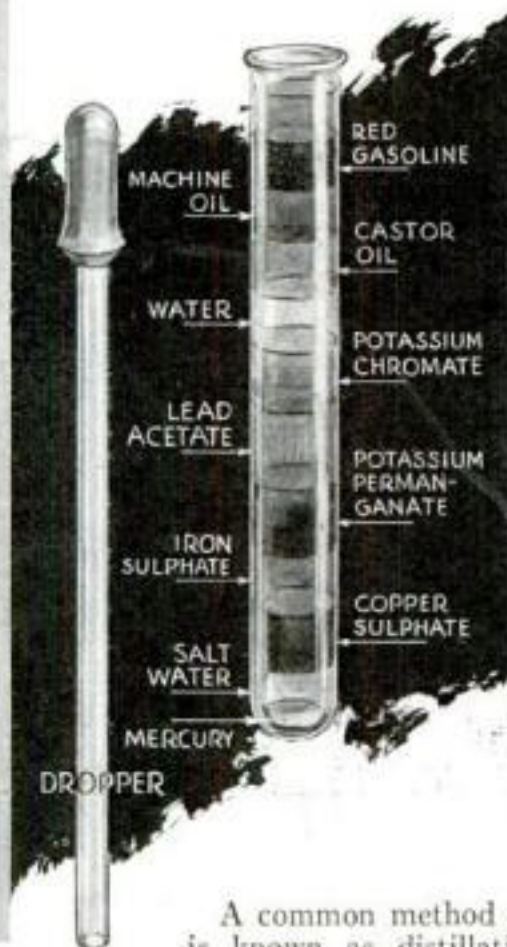


Illustration and diagram, above, show how to make a Jacob's tube. A long dropper with a rubber bulb is used in placing ingredients in the tube so they will not mix



A common method of purifying liquids is known as distillation. As applied to water, distillation forms a practical as well as interesting experiment for the amateur chemist. Distilled water, free of impurities, is a useful article to have around the home laboratory.

A simple distillation apparatus can be made from an olive bottle, some glass tubing, two cork stoppers, and a rubber tube. The liquid to be distilled is placed in the distilling flask which can be supported on an improvised stand made from discarded tubular curtain rods. The flask should rest on a square of iron fly screening large enough to cover the stand.

The olive bottle with its bottom removed forms the water jacket for the condenser tube leading from the distilling flask. Two shorter tubes, one placed in each stopper, form the inlet and outlet for the circulating water which flows in the jacket. The inside of the long condenser tube should be not less than one-quarter of an inch in diameter.

**T**O OBTAIN perfect cooling of the condenser tube, the circulating water should enter the jacket at the lower end and leave at the upper end. In this way, the water next to the hottest part of the condenser will be immediately withdrawn and replaced by cooler water.

To distill water, place it in the distilling flask and heat it with a Bunsen flame. As the water boils, steam will be generated and this will flow out of the flask into the cooled condensing tube. When the steam strikes the cold surface of this tube it is condensed and pure water, minus the

impurities which do not boil off, drips from the condenser into the receiving beaker as shown in illustration above.

If no running water is available for the condenser jacket, a suitable supply can be had by rigging a syphon from a large jug of water placed high above the table.

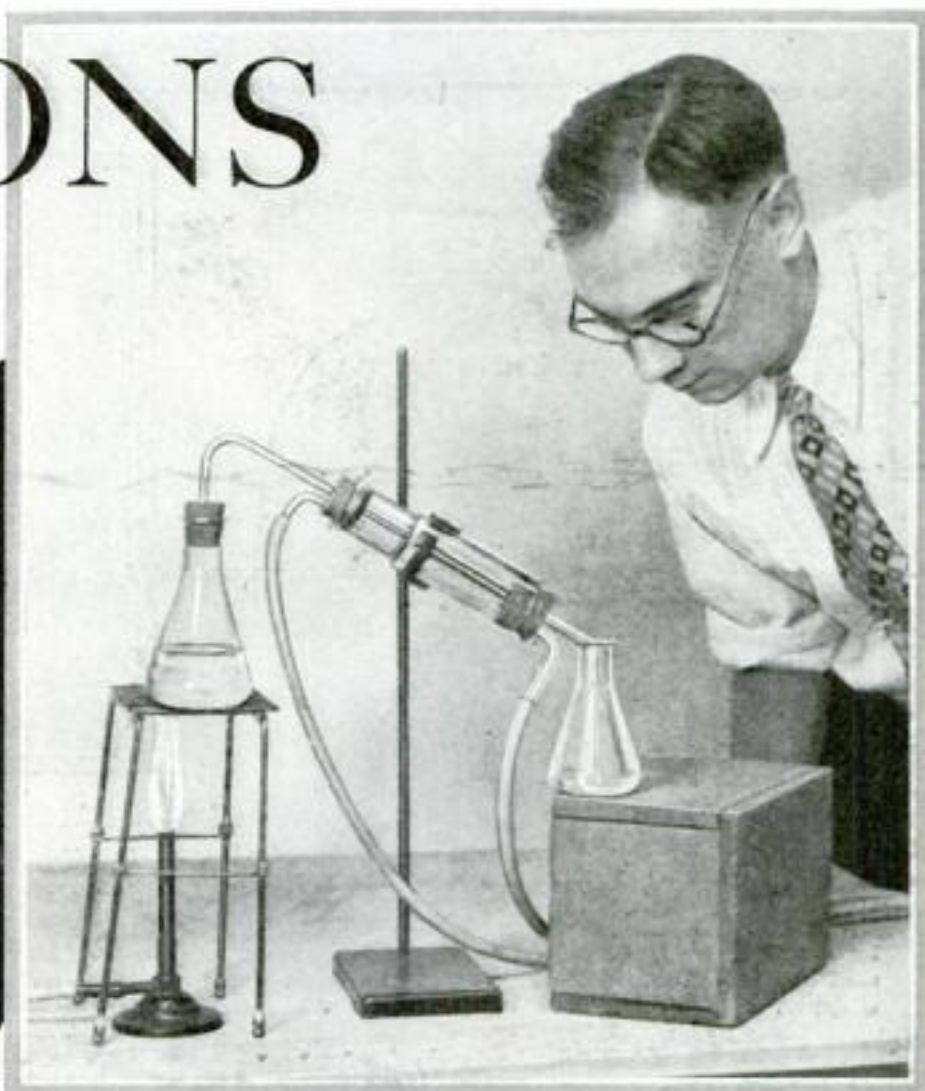
**I**F LEAKS should develop in the corks at each end of the condenser jacket, they can be stopped by applying shellac to the cracks.

By fitting the distilling flask with a separatory funnel, like the one described in a recent issue (P.S.M., June '32, p. 64), the supply of water can be continually replenished without stopping the process of distillation.

To demonstrate the purifying action of distillation, the home chemist can place a strong water solution of salt in the distilling flask. The final distillate, which drips from the condenser tube, will have no trace of a salty taste. A simple apparatus of this type is often carried by aviators when they attempt a flight across the ocean. Should they be forced down, drinking water can be made by distilling sea water.

If a blue solution of copper sulphate is placed in the distilling flask, the distillate will be pure, colorless water. In both of these experiments the impurities in the water and the original substance dissolved remain in the flask.

We have seen by various experiments illustrating diffusion that such substances as sugar and copper sulphate when dropped in water sink down and slowly dissolve to form a strong (Continued on page 82)



A bottle, two beakers, some glass tubing, cork stoppers, and rubber tubes are all you need for experiments in distillation. This apparatus is connected up as shown above. Steam from the left hand beaker condenses in tube inside bottle held by upright and drops into beaker, right

when cooking oatmeal. The solution to be evaporated is placed in a shallow dish which rests on the open top of the beaker. Substances crystallized out from solutions made from distilled water prove to be purer than before being dissolved.

**A**NOTHER method of purifying certain substances is called sublimation. This process can be demonstrated with moth balls or moth flakes (naphthalene). Crush the balls or flakes and place them in a shallow tin cap taken from an empty can of baking powder. Put an alcohol burner or other small flame under the improvised dish and heat slowly. Soon, you will notice a heavy vapor rising from the powder. This vapor consists of small particles of naphthalene. If a cool body, such as a glass or flask filled with cold water, is held above the dish, this vapor will sublime on the chilled surface in the form of beautiful, flaky crystals of pure naphthalene. These shiny crystals will grow to a quarter of an inch in length if the process is continued. The crystalline formation will not be permanent, however, as the naphthalene will vaporize in the air. Just as moth balls disappear or become smaller when they are packed away in a closet or chest for any length of time, so the naphthalene crystals will vanish.



# New Conveniences



**ELECTRIC MIXER AND CAN OPENER.** Driven by a small motor, this new kitchen utensil, which is said to cause no radio interference, combines a meat chopper, can opener, and also a knife sharpener

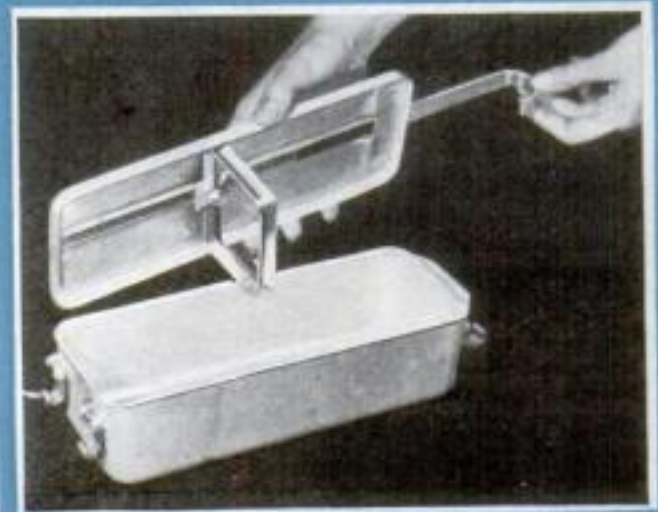


**MILK BOTTLE CAPS.** With a spear-pointed rod, fastened to a wooden handle, milk bottle caps can be lifted out

**REFRIGERATOR FREEZES ICE CREAM.** The freezer, two views of which are shown below, is filled with mixture and placed in refrigerator. As it begins to freeze, handle is pushed in and out to mix contents. Pictures show freezer in use and also with top removed



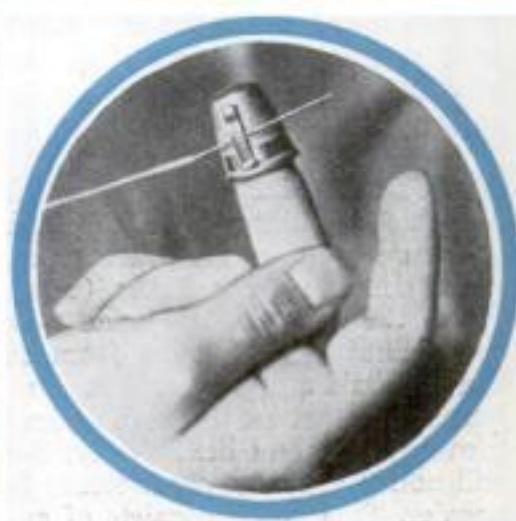
**PROTECTS YOUR TABLE.** Below is shown a combination coaster and ash tray which guards table from liquid stains as well as from burns



**LOOSENS ICE TRAY.** Tipped with rubber, this tool is specially designed for use in prying out ice trays. Handle shoved forward against shank jars the tray loose



**BUTTON ON SALT SHAKER.** Salt flows from this shaker when a white button is pressed and pepper comes at pressure on a black button. Movable cork breaks up salt lumps so they will flow easily

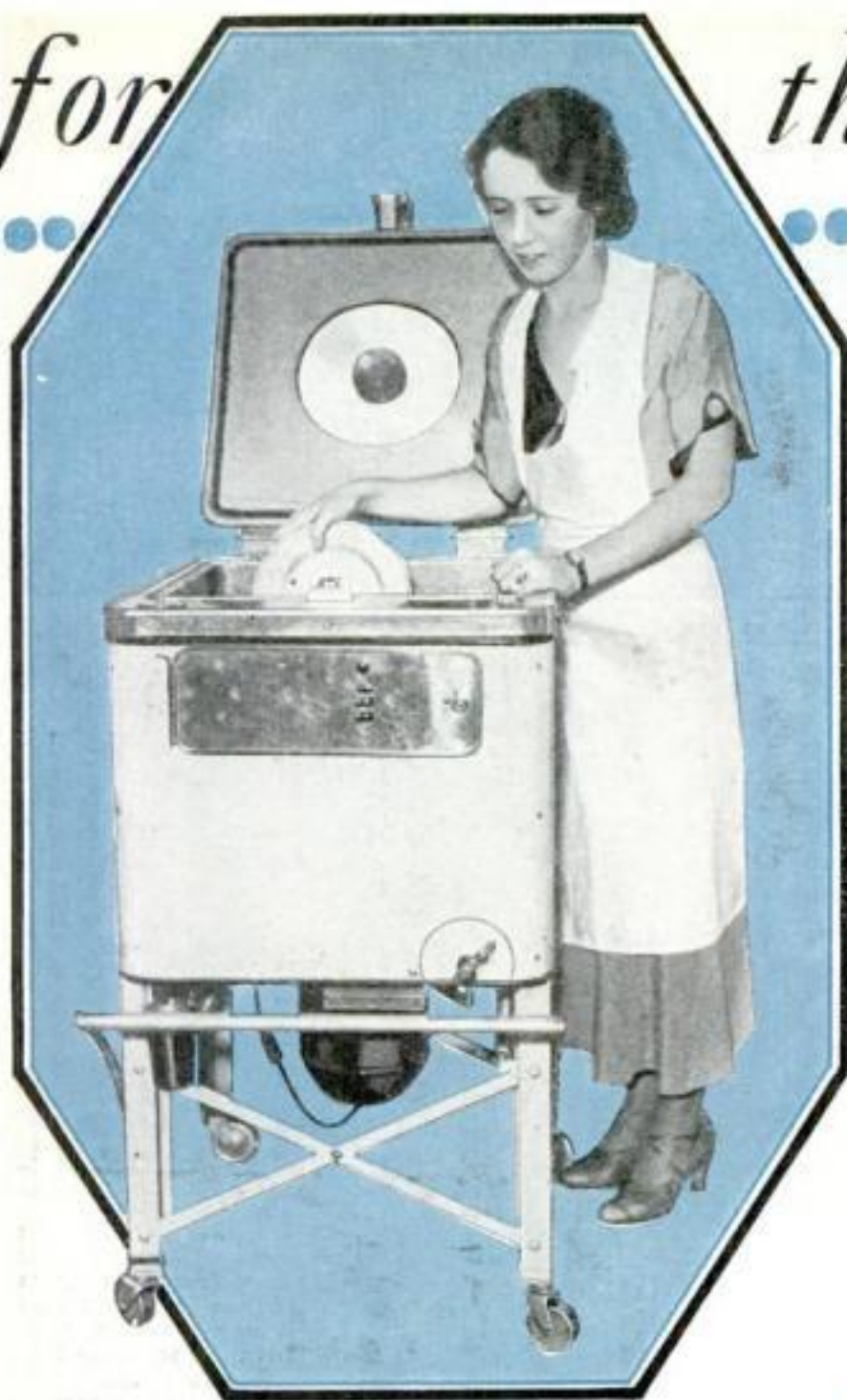


**THIMBLE HOLDS NEEDLE.** Those who sew will appreciate this combination thimble and needle holder. It is especially useful when work is being done on heavy material through which it is hard to pass the needle without letting it slip

**KEEPS THE PLATES WARM.** In addition to drawers in which are stored pots and pans and other kitchen utensils, the new range shown at left, has a plate warming compartment that can be turned on without interfering with the other things that may be cooking at the time



# for the HOME •



**WASHES DISHES ALL BY ITSELF.** When dishes are placed in this electric dishwasher, all you need to do is add water and soap powder and then you can go away and leave it to its own operations. It will wash the dishes in soapy water, rinse them off a couple of times in clear water, sterilize them and dry them, and finally shut itself off when the job is done. All of these things are done without the touch of human hands, which is a good thing as the machine uses water hotter than you could stand. As shown above, the machine is extremely compact. A surprising feature is its simplicity, there being only two movable parts in it

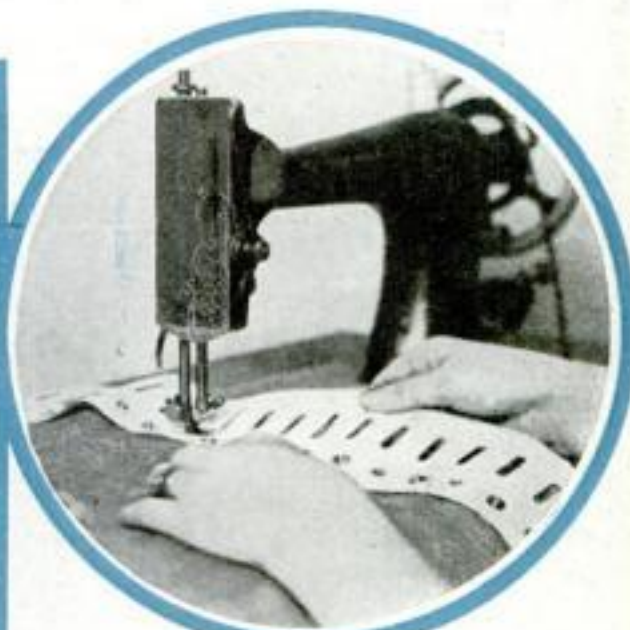
**RUBBER COVERS THAT PROTECT HANDS AND WALLS.** When the rubber cover, shown at right, is slipped over the valve wheel of a radiator there is no danger of burning the hands in turning it on or off. The covers can also be used on door knobs to keep them from marring walls if they fly back accidentally



**EGG OPENER.** The device seen at left is fitted over the top of an egg and when a lever is pressed down, knives are forced through the shell. When the opener is lifted up, the shell comes with it and the egg is ready to eat. If desired, the opener can be used conveniently to separate the yolk from the white of an egg



**PERFUMED LIGHT.** A wire spring clip to which perfume is attached, is slipped over a light bulb. The heat from the bulb releases the perfume which is carried into the room by the hot air currents so that all disagreeable odors are destroyed



**CHANGEABLE DRAPERIES.** Headings for draperies, that attach with nickelplated snap fasteners and equal spaced slots, make it possible for the housewife to change the style of her draperies with little trouble

**THERMOMETER TO TEST ROAST.** At left is shown a sharp-pointed thermometer which is thrust into a cooking roast to find out if the meat is being kept at the correct temperature all the way through. In this way you are able to tell the instant the meat is thoroughly cooked



**PARER EASY TO CLEAN.** A removable blade on the new paring knife shown at left makes it easy to keep clean. The blade is springy and easily snaps in or out of place. A small metal ring on the handy device may be used for peeling an orange





Hill of Death cemetery on Italian-Austrian border in which war objects are used as tombstones

## WORLD'S STRANGEST TOMBSTONES MARK SOLDIERS' GRAVES

PROBABLY the strangest tombstones in the world are to be found in a cemetery near the Italian-Austrian border, where the Italians suffered their greatest losses and where 30,000 of their war dead lie buried. Each marker recalls the occupation in life of the soldier whom it commemorates. Thus a full-sized traveling kitchen stands over the grave of an Army cook. A military searchlight forms a monument over the tomb of those who were killed while operating it. Crossed skis are posed in tribute to an Alpinist killed in the mountain campaigning. A typewriter, probably the first to decorate any cemetery, marks the last resting place of a clerical worker in the Army service. A torpedo, anchor, and chain mark the resting place of members of a naval battery.



For the first time in history, a typewriter rises above the grave of the soldier who used it for army office work. Left, torpedo, anchor, and chain mark the spot where members of naval battery perished

## FLASHLIGHT OF MANY USES HAS NO BATTERY

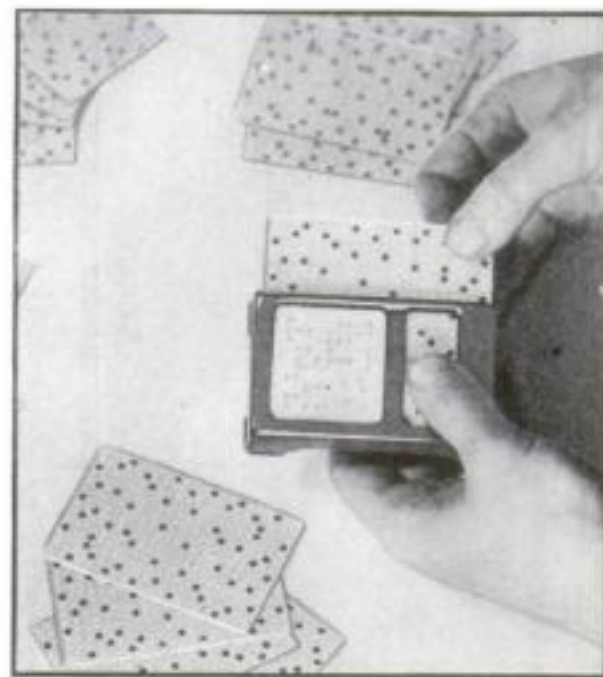
FLASHLIGHTS that run without batteries have appeared before, but a new model has been placed on the market with a set of attachments that give it unusual versatility. In a few seconds it may be transformed from a hand flashlight into a "candle lamp" for campers, so that it may be stood on a table to furnish light, as shown in the photograph. An extension cord may be plugged in to give a convenient light for examination of the throat, by a physician or home nurse. Special lenses also adapt the flashlight for use in a photographer's darkroom. Two spare lamps are held by spring clips back of the reflector. There are no batteries to be replaced, since an efficient little dynamo within the case supplies current for the bulb. A few turns of the handle wind a spring motor which furnishes sufficient power to operate the dynamo for several minutes, during which time the bulb throws out a light as strong as that from any battery flashlight.



Flashlight, run by dynamo, can be used as candle lamp and has cord and bulb for throat examinations

## PRACTICE BRIDGE HANDS DEALT WITH NEW SET

PREPARED contract bridge hands, for practice and study, may be dealt with a new set consisting of a special pack of cards and a metal chart. The backs of the cards are marked with black dots in different patterns according to the suit and denomination. When the cards are inserted one by one in the chart, as in the photo, the dots show through holes in the chart and arrows indicate to which player each card should go.

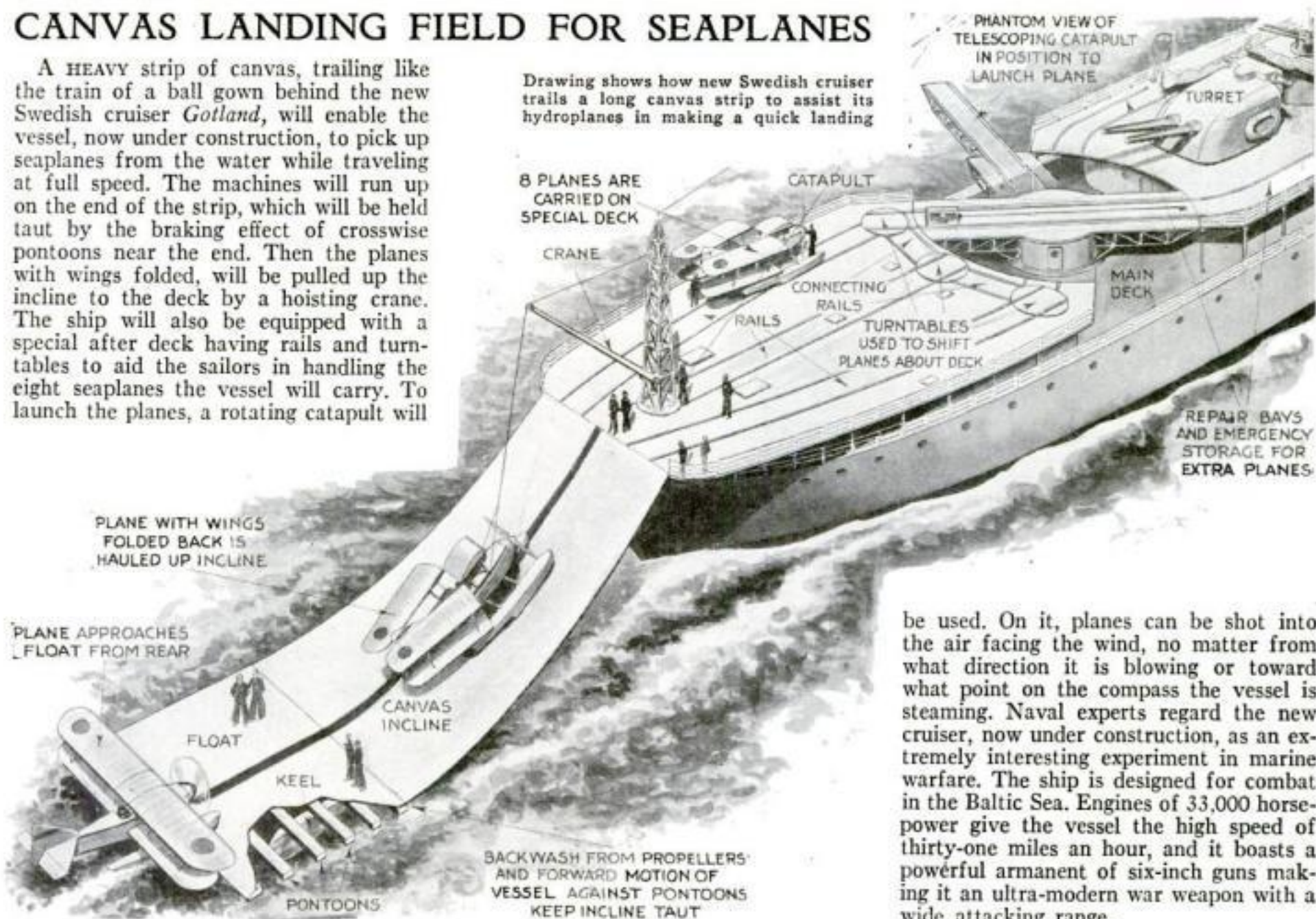




## CANVAS LANDING FIELD FOR SEAPLANES

A HEAVY strip of canvas, trailing like the train of a ball gown behind the new Swedish cruiser *Gotland*, will enable the vessel, now under construction, to pick up seaplanes from the water while traveling at full speed. The machines will run up on the end of the strip, which will be held taut by the braking effect of crosswise pontoons near the end. Then the planes with wings folded, will be pulled up the incline to the deck by a hoisting crane. The ship will also be equipped with a special after deck having rails and turntables to aid the sailors in handling the eight seaplanes the vessel will carry. To launch the planes, a rotating catapult will

Drawing shows how new Swedish cruiser trails a long canvas strip to assist its hydroplanes in making a quick landing

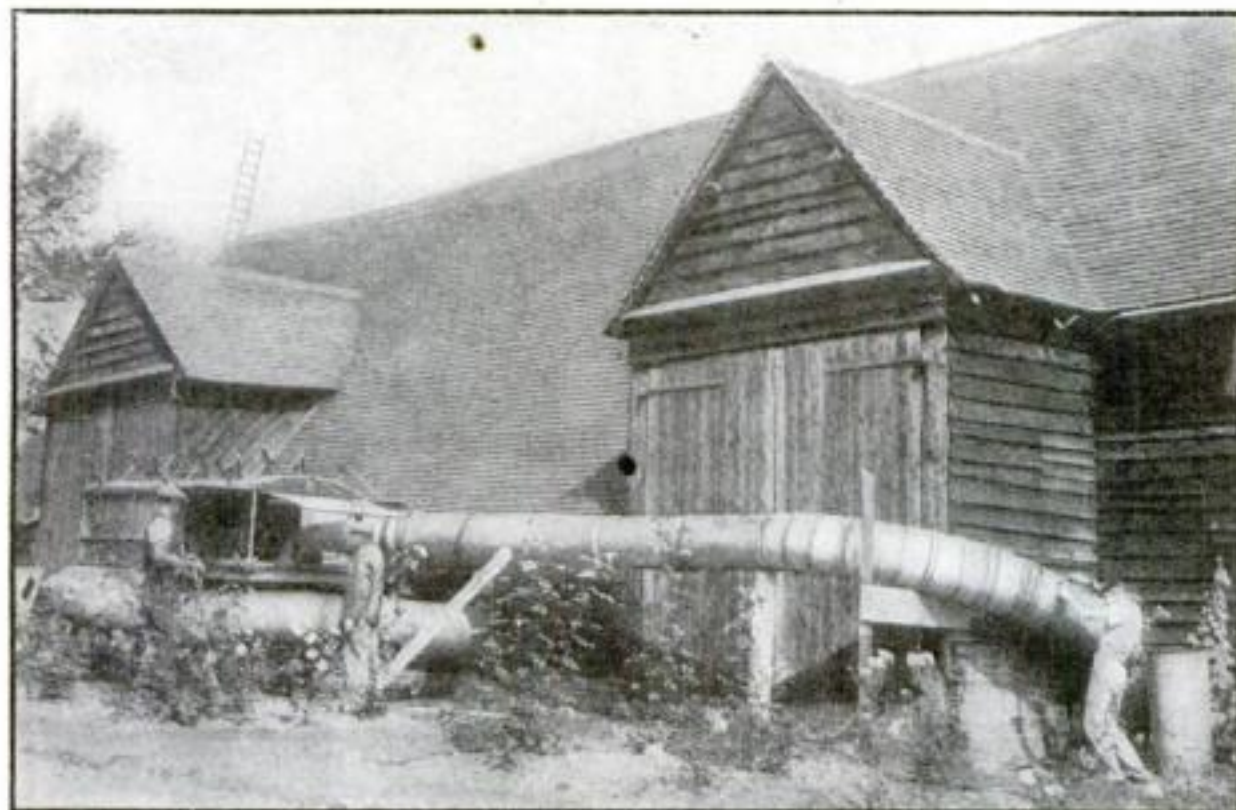


be used. On it, planes can be shot into the air facing the wind, no matter from what direction it is blowing or toward what point on the compass the vessel is steaming. Naval experts regard the new cruiser, now under construction, as an extremely interesting experiment in marine warfare. The ship is designed for combat in the Baltic Sea. Engines of 33,000 horsepower give the vessel the high speed of thirty-one miles an hour, and it boasts a powerful armament of six-inch guns making it an ultra-modern war weapon with a wide attacking range.

## HOT AIR KILLS DEATH WATCH BEETLES

SUPERHEATED air is England's latest weapon against the ravages of the "death watch beetle." The ticking sound made by this curious insect is thought by superstitious persons to be an omen of death. Actually its unwelcome activities take a more practical form. The grubs attack the wooden beams of ancient structures and reduce them to crumbling shells. Such historic buildings as Westminster Hall and

Chequers, the official residence of the Prime Minister, have been riddled by the pest. When it recently attacked a famous old barn near Beaconsfield, which is supposed to have supplied the timbers for the Pilgrim vessel *Mayflower*, strenuous eradicating methods were called into play. Huge pipes have been rigged up leading into the barn, and extremely hot air is being forced from them to kill the beetles.



Barn near Beaconsfield, England, that supplied the timbers for the famous ship, *Mayflower*, is being saved from ravages of death watch beetles with hot air pumped into it through big pipes



This measuring club, with a movable head that registers angles on a graduated scale, is used by a golfer in selecting clubs that are best suited to his particular stance

## GAGE HELPS GOLFER FIT CLUBS TO HIS STANCE

A "measuring club," invented by a Manchester, England, golfer, helps players in selecting golf clubs suited to their stance. While all players require clubs of such shape that the sole lies flat on the ground, variations among individuals in length of arms and legs make it impossible for all to use an identical design. A prospective purchaser may therefore be fitted with the aid of the measuring club. When its movable head is adjusted to suit the player, an indicator on a scale shows the angle of the head to the ground that will be most satisfactory for him.



# Easy Tests of Strange Facts



**HOMEMADE** microscope of Canada balsam reveals hidden wonders. . . Simple apparatus needed to produce singing wire. . . How your breath can print picture on a tiny bit of hot copper



**MAKE YOUR OWN MICROSCOPE.** In a piece of tin punch a hole with a large needle. Then melt some Canada balsam, which you can get at any drug store, and place a single drop of it on the hole, being careful to see that it does not run. When the balsam hardens you will have a microscope more powerful than one with a glass lens

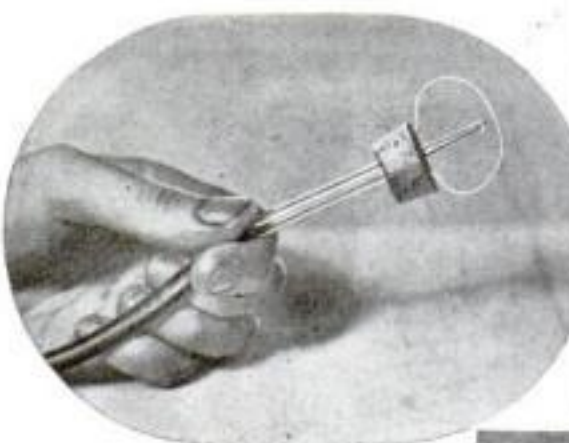


**A METAL CRICKET.** Hammer a small disk of metal, tin preferred, into a hollow dish shape. With a pair of pliers, hold the disk over an alcohol flame. As the metal gets hot, a point will be reached at which the disk will suddenly turn itself inside out with a loud click. Discovery of this action led to click flatiron and made one man rich



## MOVING A WEIGHT WITHOUT TOUCHING IT.

Fill a bottle with water to overflowing and in it drop a sealed capsule in which you have placed a small weight. Cork the bottle and then, as shown above, press it down with the hands. As you do so, the weighted capsule rises. As you relieve the pressure, it will sink again. Sometimes pressing sides of bottle will move capsule

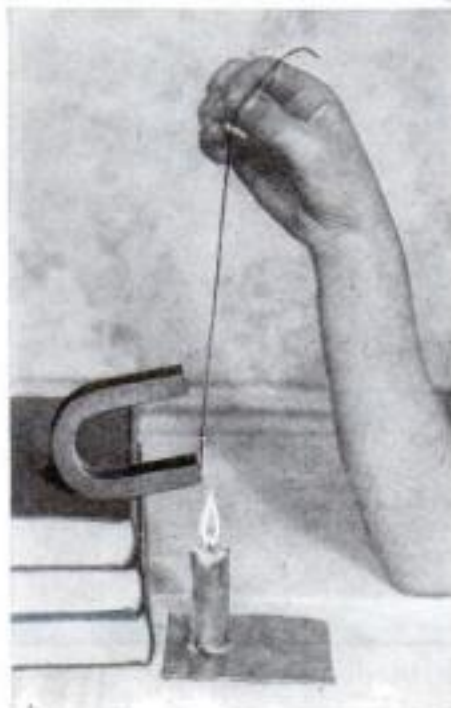


## THIS WIRE WILL SING.

Cut a hole through a cork and insert a medicine dropper. Then make a loop of fine wire, sticking the ends in the cork so the loop is across the small end of the dropper. Attach a piece of rubber tube to the large end of the dropper. If you hold the device in a draft of air and place the tube to your ear, you will hear music

## MAKING A DIME JUMP.

Place oil around the mouth of a bottle and over this lay a dime so that the bottle is hermetically sealed. If you then warm your hands and hold them around the bottle, as illustrated at the right, their heat will warm the air in the bottle and this, expanding will make dime jump off bottle



## A PICTURE ON METAL

Polish a piece of sheet copper and on it place a silver coin. Hold the copper over a flame as illustrated until both copper and coin become thoroughly heated. Then remove them from the flame and permit them to cool off slightly. If you then dislodge the coin and breathe upon the spot where it lay, a sharp outline of it will appear

## HEAT ENDS MAGNETISM.

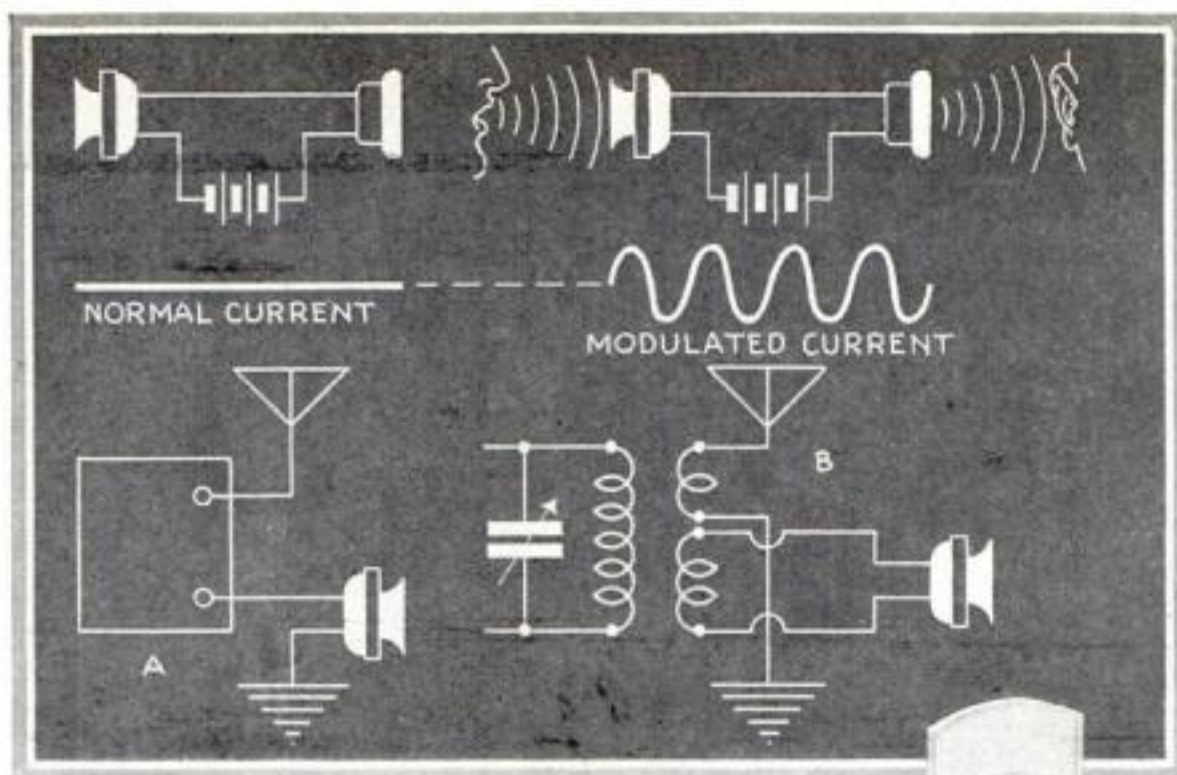
The experiment illustrated at left has interesting possibilities. Attach a needle to a small wire and let it swing against a horseshoe magnet beneath which is an alcohol flame. As the needle becomes hot, it will fall away from the magnet but as it cools it will return to its original position



**MEASURING SPEED OF HEAT.** You can prove that different metals conduct heat at different speeds by this simple experiment: Take a piece of copper wire and a piece of iron wire and lay them on a cake of paraffin as illustrated above. Beneath the wire ends place an alcohol flame. The paraffin under the copper melts first as heat moves faster through copper than iron







Drawing, left, shows how current in battery operated telephone circuit is modulated by sound wave striking diaphragm of microphone. A and B show way of connecting microphone. Below, good carbon microphone

# JOHN CARR tells *How You Can* Talk Over Radio Transmitter

**S**IMPLE experiments with an inexpensive microphone offer new thrills to the amateur whose activities have been confined to a key-operated transmitter. By making a few changes and additions to his continuous wave set, he can take advantage of the three frequency bands provided for amateur radio telephone communication.

The basis of radio telephone operation is the process of modulation and most common of all modulating systems is the battery-operated land telephone circuit consisting of a simple carbon microphone, a battery, and an earphone.

In a sense, the carbon microphone is a variable resistance controlled by the sound waves striking its flexible metal diaphragm. Small granules of carbon, held in a metal shell in back of the diaphragm, become more or less tightly packed depending on the pressure of the sound waves against the diaphragm. When they are pressed tightly together, the resistance of the microphone is decreased; when they are allowed to spread apart, the resistance is increased.

When no sound waves enter the mouth-piece, the resistance of the microphone is constant and the current flowing in the circuit is also constant. When sound waves strike the microphone, its resistance is altered and the current flowing in the circuit varies accordingly. At the earphone, this varying current is converted back into sound waves by the action of the electromagnet on a thin metal diaphragm. The process of superimposing the sound waves on the normal current flowing in the circuit is called *modulation* and

the current is said to have been *modulated*.

To compare this simple system with a radio telephone, it is necessary only to replace the battery with a generator of continuous waves and to substitute a radio receiver for the earphone.

In a radio receiver, the radio-frequency current in the circuit conforms with the current in the transmitting antenna. In other words, any variation in the antenna current at the transmitter is faithfully reproduced at the receiver. Changing the antenna current of a continuous wave transmitter according to sound vibrations is basis of radio telephone modulation.

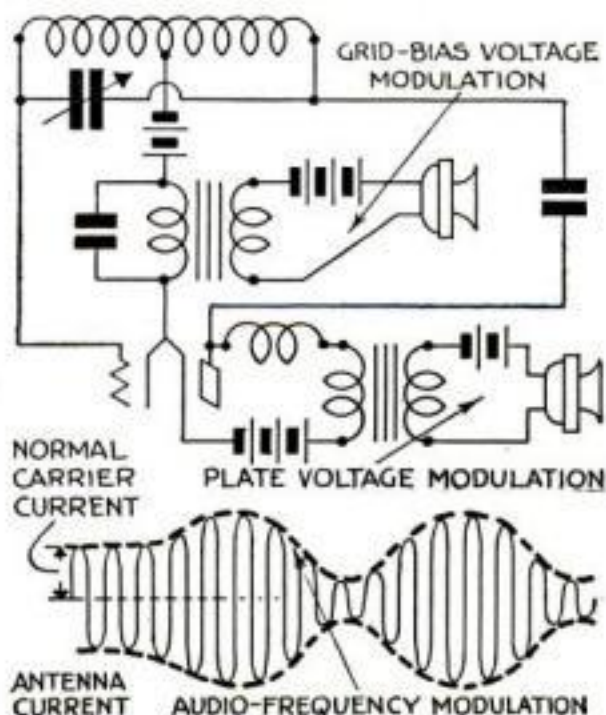


Diagram of grid-bias and plate voltage methods of modulation and antenna current changes

One of the simplest ways to vary the antenna current according to sound waves is to connect a simple carbon microphone of the telephone type into the antenna circuit of the transmitter as shown at A in the drawings. Any changes in the resistance of the microphone, caused by sound waves, will then cause corresponding changes in the antenna current. Although such an elementary system is not practical where quality is desired, a microphone can be connected in this manner provided it is of the proper normal resistance.

Another simple way to vary the antenna current according to sound waves is to connect the carbon microphone as shown at B. In this case, the microphone is not connected directly into the antenna circuit but is placed in series with a few loops of insulated wire that are closely coupled to the antenna inductance. When sound waves strike the microphone, the resistance of the loop circuit is varied accordingly and more or less energy is absorbed from the antenna.

Because both of these methods absorb energy from the system, they are called "absorption methods of modulation." With both systems, the quality is poor and the efficiency is low.

Obviously, a better way to obtain modulation would be to vary the generated voltage. This could be done by varying the filament voltage, the grid-bias voltage, or the plate voltage. Of these, the grid-bias and plate voltage methods form the basis for common systems of modulation used in radio telephones.

In both the grid-bias and plate voltage circuits, the mi- *(Continued on page 95)*



# Making Car's Radio

*RECEIVER in Auto Must Be Built and Installed so It Can Stand Road Shocks and Vibrations—Interference Due to Spark Plugs Can Be Reduced with the Right Use of Suppressors*

By **GEORGE H. WALTZ, JR.**



Receiver is mounted behind the instrument panel but attached to the steering post is a remote control by which the set is regulated

**D**EFINITE installation problems confront the amateur who contemplates adding a radio receiver to the other ordinary equipment of his automobile.

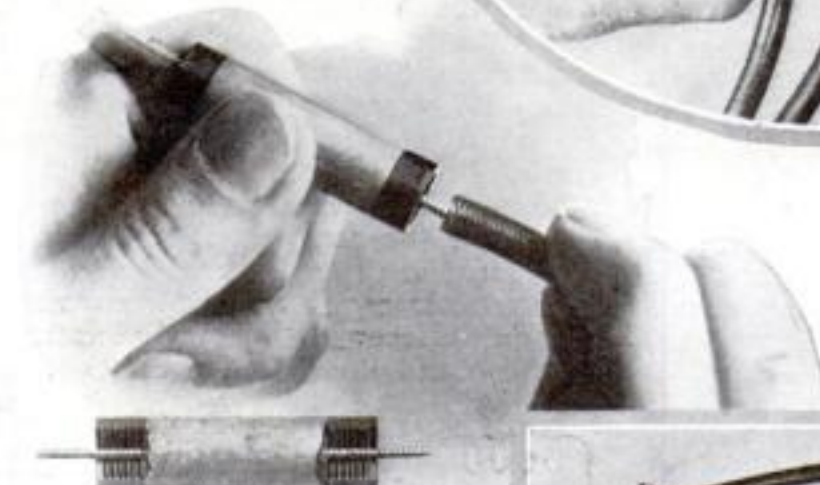
First of all, varying conditions of location, temperature, and climate, and the lack of a good antenna and a positive ground make it necessary to use a very sensitive receiver constructed from high-grade parts and supplied by an efficient power system.

If batteries are used for the B-supply, they should be the best obtainable and should be placed in a sturdy battery box. This box should be located close enough to the receiver to allow short leads but not too close to the motor as excessive heat will ruin the batteries.

Because of evident space limitations, the receiver must be compact and should be mounted in a metal case so designed that it allows easy access for repairs.

Unlike the home broadcast receiver, the automobile set must be constructed to withstand severe road shocks and continuous high speed motor vibrations. For this reason, small, sturdy variable condensers should be used and all interior wiring should be made fast to prevent shifting.

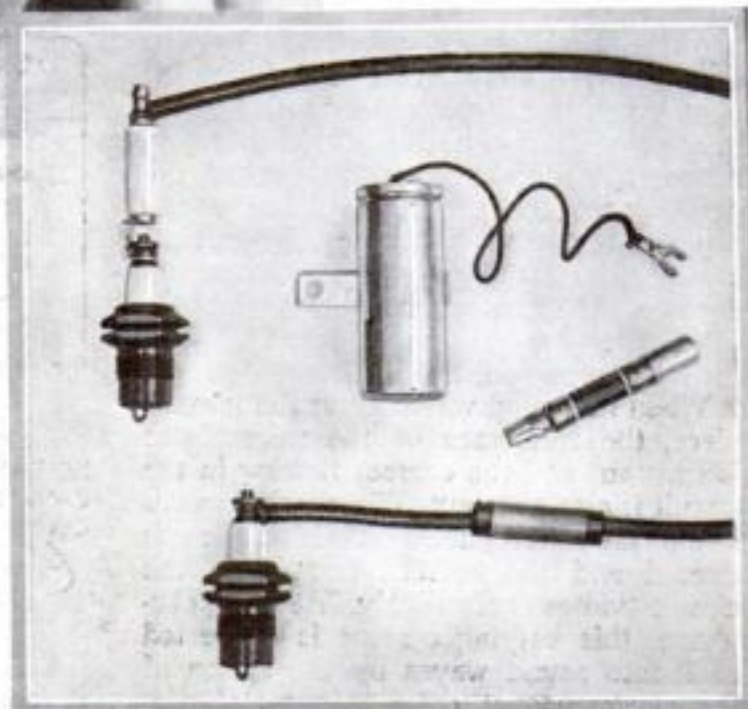
Since their heaters are designed to operate efficiently from a six-volt automobile battery without a rheostat or fixed resistor, the type '36, '37, and '38 tubes are recommended for automobile use. These



Above, a suppressor is being placed in the center tap of the distributor cap to cut out interference. At left, a screw point on each end of suppressor is screwed into the cut end of the ignition wire to eliminate disturbance

tubes prove satisfactory even under the voltage fluctuations caused by charging and discharging. Some automobile receivers also use a type '39 tube.

Automobiles equipped for radio by the manufacturer usually are provided with a built-in antenna of wire mesh. These fill the space under the roof of the car, are entirely hidden from view by the roof lining, and are installed carefully to avoid unnecessary interference noises. Being high and relatively free from the metal work of the body and frame, the roof type of antenna is undoubtedly the best you can procure.



Here are two types of suppressors used in cars. One at top is attached to plug and below it, one placed in spark plug wire. In center, condenser for generator



# Give Best Results •

While the amateur mechanic can install a built-in antenna of this type by using regular copper wire mesh, (about No. 16 is satisfactory) the removing and replacing of the roof lining material proves a difficult job even for the experienced upholsterer. Special auxiliary antennas, now available, provide a simple solution to the problem.

One commercial type of antenna, for roof installation, resembles a modernistic panel when fastened in place under the roof of a car. Being covered with a material to match the upholstery, the antenna panel blends with the background and forms a part of the interior. For best results, the panel should be placed at about the center of the roof. Of course, the best position will vary according to the placing of the dome lights. These antenna units can be obtained in various sizes and with coverings of different color to match the make, model, and upholstery of the car.

Other auxiliary antennas are made for use under the car. These can be obtained for installation under one or both running boards or under the frame of the car. The running board type illustrated on this page, fits snugly under the running board where it is hidden from view and protected from injury. The other type is equipped with four substantial canvas straps so that it can be suspended between the front and rear axles. All these auxiliary antennas are sold complete with lead-in wires.

**O**F COURSE, the amateur can also install a simple antenna by tacking wire, zig-zag fashion, to the underside of the roof. In most cases, this type is inefficient.

In an automobile, no actual connection with the ground is possible so that the whole frame of the car is used in the manner of a counterpoise performing the same function as a ground but not doing the work nearly as efficiently.

Unfortunately, interference troubles are present in abundance in an automobile. The principle source of trouble being the high tension wiring of the ignition system. As each of the four, six, eight, twelve, or sixteen cylinders goes into action, the igniting spark at the

## A B C's OF RADIO

**R**ADIO waves can be specified in wave length or frequency. As the names imply, wave length is the length of each wave and the frequency is a measure of quantity in terms of the number of waves that pass a point in one second. For consistency, wave lengths are measured in meters and frequency in kilocycles. Since radio waves travel about 300,000 kilometers a second it is a simple matter to figure either value if the other is given. Dividing 300,000 by the wave length gives the frequency in kilocycles and dividing 300,000 by the frequency gives the wave length in meters.

plug induces high-frequency oscillations in the high tension wiring and these are radiated to the receiver.

To suppress these oscillations, 25,000-ohm resistors are placed in each spark plug lead and in the high tension lead to the center tap on the distributor cap. Resistors designed for this purpose are called suppressors and can be obtained in complete sets from dealers in radio parts and supplies. To be most effective, these resistors should be placed as close to the source of trouble as possible—directly at each spark plug and at the distributor cap.

Of course, on some makes of cars it may be impossible to place suppressors directly at the spark plugs. If this is the

case, similar resistors can be placed directly in the spark plugs leads as shown on the preceding page or they can be placed at the distributor cap.

Sparkling at the brushes of the generator is also a source of troublesome interference. To overcome this, a one- or two-microfarad condenser is connected to the frame (ground), from the wire that delivers power from the generator. Interference originating at the low tension breaker arm can be partially eliminated by connecting a condenser across from the supply lead on the coil to the frame.

**W**HEN receivers, as in most cases, are mounted under the instrument board, precautions must be taken to prevent any interference from wiring, ammeter, and ignition lock. For instance, it may be found necessary to supply a better ground for the steering column and such controls as the choke and spark rods. Similarly, the wires leading to the ammeter should be twisted together for a large portion of their length to neutralize any magnetic effect formed by the voltage fluctuations in the wires. If the ignition coil is mounted on the cowl panel opposite the receiver, it may be necessary to shield it.

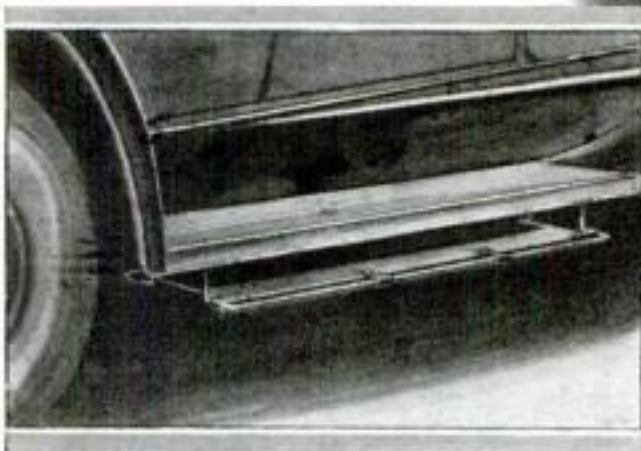
Auxiliary electrical equipment, such as electric windshield wipers, cigar lighters, electric gasoline gages, or fans, is often found to be a source of annoyance. A condenser, connected across the particular lead in question to the ground, will generally eliminate this form of interference.

To test an installed radio receiver for local interference, adjust the receiver so that it is operating but not tuned to a station. Interference noises can then be heard in the loudspeaker. For best results, interference tests should be made along a country road where other external interference is generally reduced to a minimum.

Many readers may wonder if their home sets can be used in a car. Obviously, any sensitive receiver will work in an auto provided the unwanted noises are eliminated. Of course such a receiver, unless strongly built and well shielded, will not give satisfactory service nor will it long stand the jars and shocks.

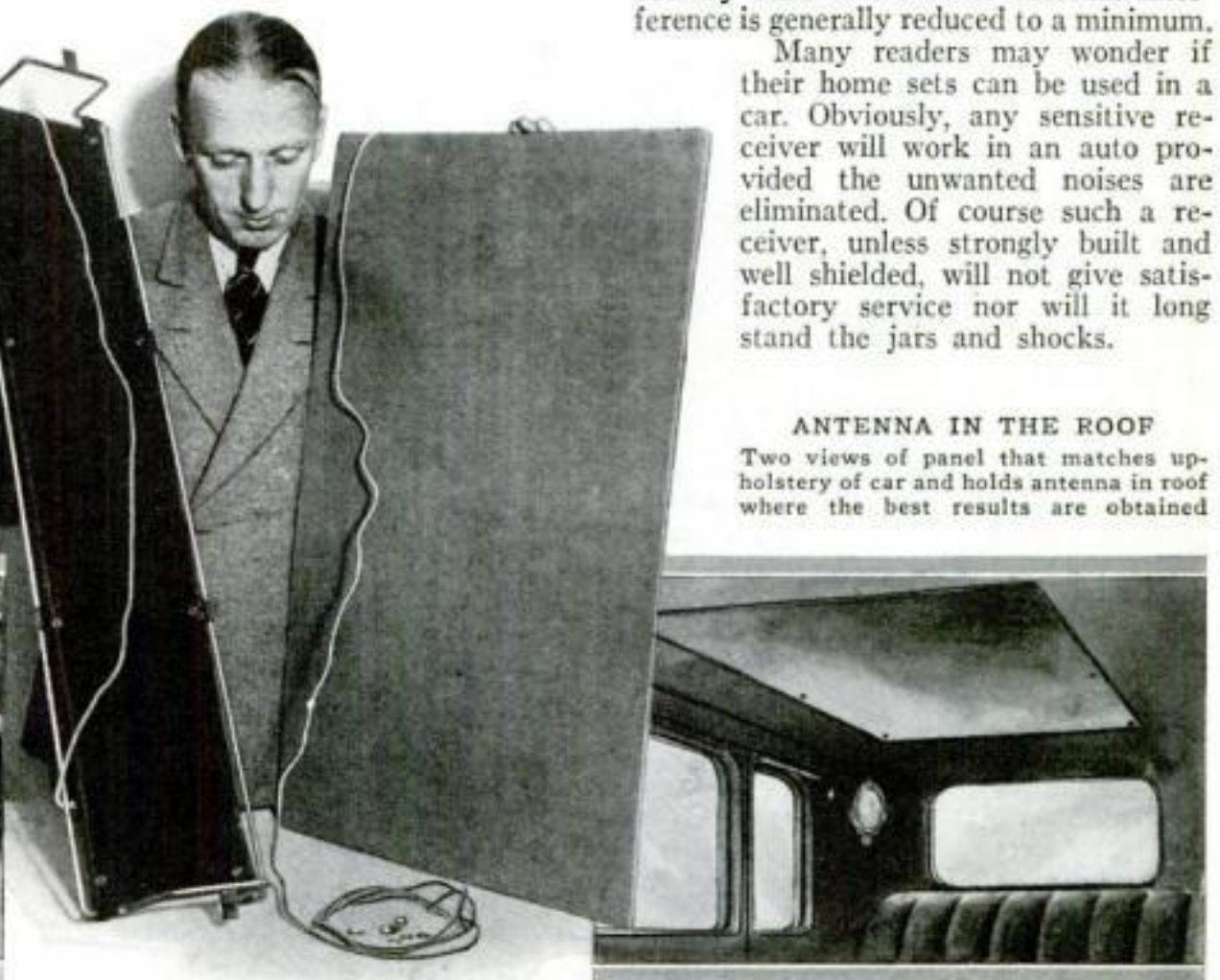
### RUNNING BOARD ANTENNA

Below and at right, two views of car antenna panel designed to be attached beneath running board



### ANTENNA IN THE ROOF

Two views of panel that matches upholstery of car and holds antenna in roof where the best results are obtained





# How to Locate Motor Knocks

## Gus Explains the Meaning of All the Strange Noises That Come from Your Car's Insides

**G**US WILSON put down his paper and glanced out of the living room window just as his next door neighbors, the Bensons, returned from their weekly tussle with Sunday afternoon traffic.

"Dan seems to be taking it slower than usual," thought Gus as the car passed at a snail's pace and came to a stop outside the Benson's house. "The missus must be back seat driving. Fifteen miles an hour isn't that lad's speed."

When his wife, four children, and pet dog were safely inside the house, Dan Benson climbed the steps to Gus's porch and held a finger impatiently and insistently on the door bell button.

"Sorry to bother you, Gus, especially on your day off," Benson apologized when Gus opened the door, "but something's wrong with that car of mine and I'm scared to drive it as far as my garage. On the way home, it acted like the engine was falling apart. All of a sudden the steering wheel began to wobble, and the further I drove the worse it got. Every time I'd start up in traffic, the whole car would shake and the motor sounded like the 'anvil chorus'."

"So that's why you drove by as though you were going to a funeral," Gus chuckled as he took down his hat and coat.

When they reached Benson's car, Gus slid into the driver's seat and motioned Dan to sit beside him. "Let's take a ride around the block," he suggested as he pressed the starter.

"Doesn't sound so bad when it's idling," muttered Gus as he leaned forward to get his ear nearer the motor. "It seems to run fine at high speed too."

Gus shifted into low gear and cautiously released the clutch pedal. The whole car began to vibrate as the motor groaned and the car jerked unsteadily ahead. Gus again tilted his head and listened.

"I don't think it's your motor," he belated over the clatter. "It must be your clutch or drive shaft. Let's go down to the garage so I can run it up on the greas-



"You've sure been riding with Lady Luck and didn't know it," Gus said as he looked up at the underside of the car. "The front end of your drive shaft is ready to come loose."

ing rack and give it the once over from underneath. Joe Clark, my partner, is down there trying to catch up on the unpaid bills. He'll be glad to see us."

Wasting little time, Gus soon had the car raised on the rack and was busily rolling up the sleeves of his Sunday shirt.

"Holy smokes," he grunted as he glanced up at the underside of the car. "You've sure been riding with Lady Luck and didn't know it."

By MARTIN  
BUNN

Joe Clark and Benson looked in the direction he indicated.

"The front end of your drive shaft's just about ready to come loose. That connection between the transmission and the front universal should have six bolts holding it together. Four have dropped out and the two that are left are on the same side of the flange and about ready to drop out too. If that drive shaft had dropped when you were going fast, the front end would have dug into the road sure as shooting and lifted the rear of your car into a front somersault."

"But, Gus," Benson asked humbly when the gray-haired mechanic had replaced the missing bolts, "what made all the noise? I could have sworn it was in the motor."

"Being loose, the connection buckled every time you gave it the gun. You see," Gus explained, using his hands to demonstrate, "the universal was connected to the transmission shaft only at one point where the two loose bolts were. Naturally there was a lot of play and every time your motor pulled, the two connecting flanges twisted and hit against the two loose bolts. Being connected off center, the shaft vibrated and the whole car rattled as though falling apart."

"It certainly sounded as if a main bearing was falling to pieces," Benson insisted.

"That's the trouble with most car owners," Gus said jokingly as he wiped his large, greasy hands on a convenient piece of waste. "Every time you hear a rattle or a noise you think it's in the bearings. Nine times out of ten, it isn't."

"Motor knocks generally occur in cycles. The majority of knocks people hear are nothing but valve noises. You've got a valve tap in that motor of yours, but I wouldn't advise tightening the tappets, because tight tappets wear faster."

"Most times, a motor knock comes from nothing more than carbon, advanced spark, or a poorly adjusted carburetor. It's best to look for the common troubles before you blame the bearings or pistons. I've had people come in here with great tales about bearing knocks and lots of them have turned out to be noises caused by loose motor fittings or bolts."

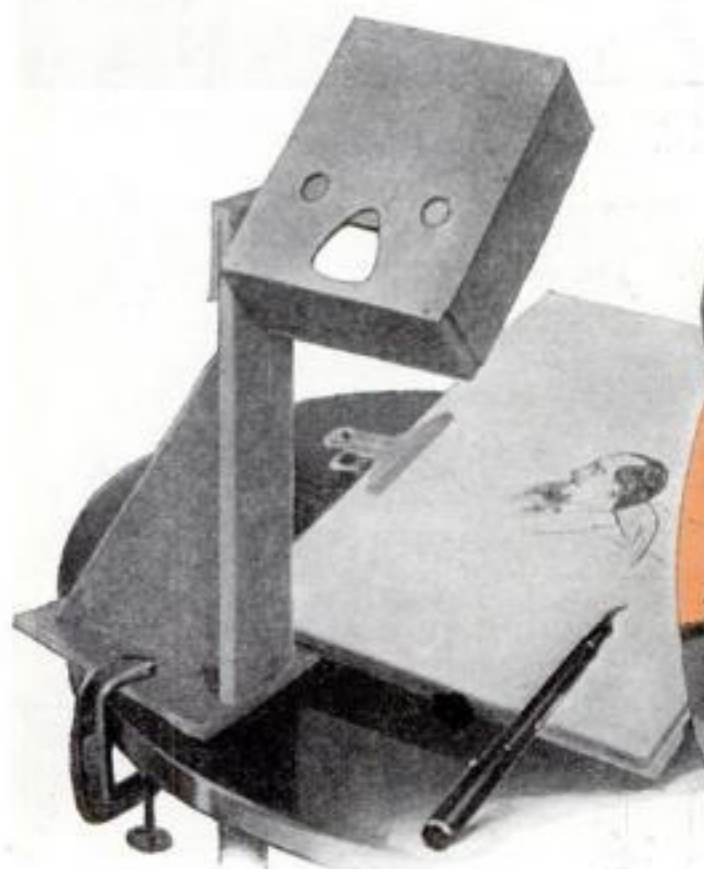
"But how can you tell one knock from the other?" asked *(Continued on page 91)*

**GUS says:** You can't carry in your tool kit all the special tools a mechanic uses but you can select your tools with care and foresight. A good set of spanner wrenches, a socket wrench, stiff wire, cotter pins, and tape make excellent additions to your repair equipment.

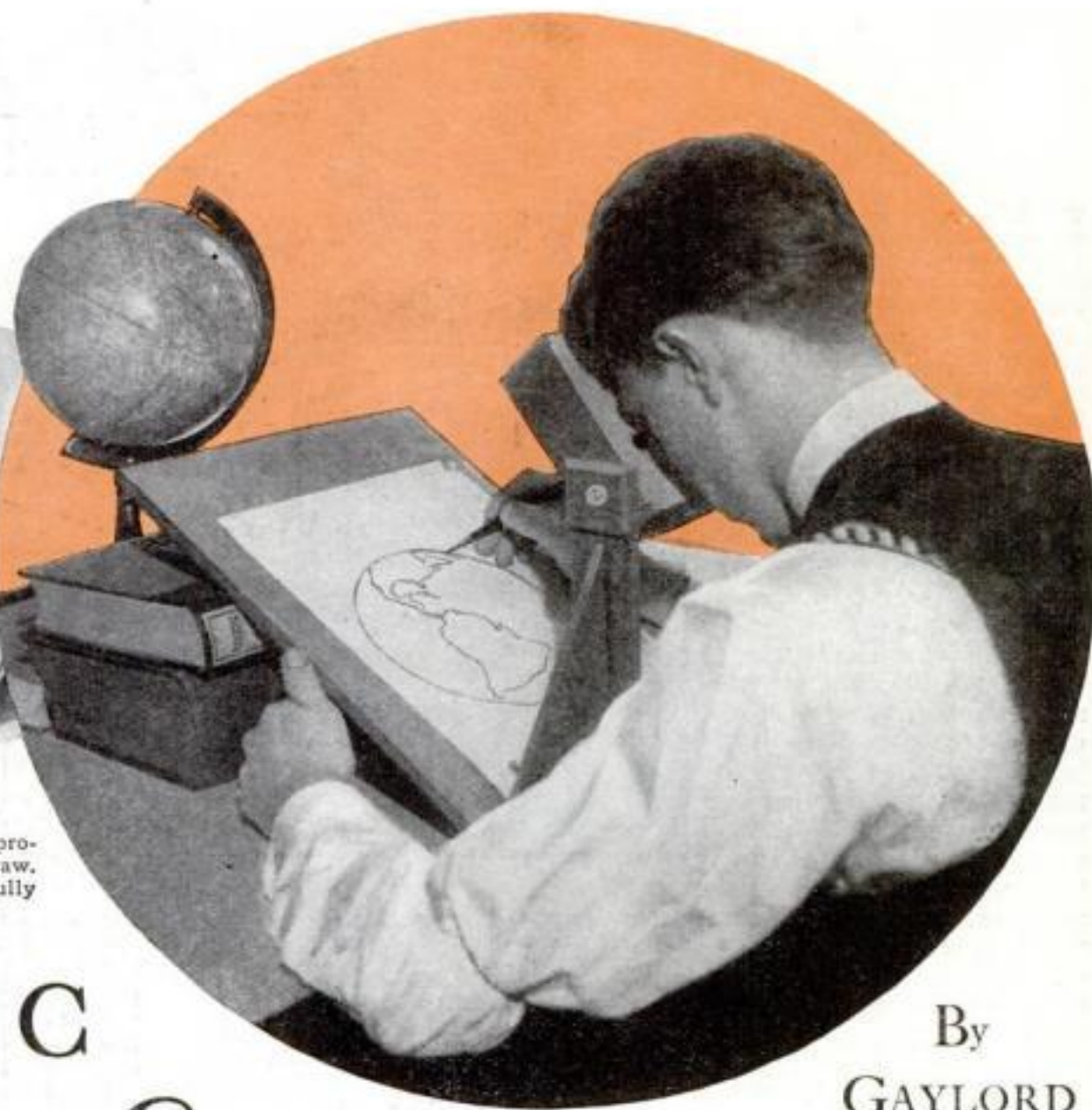


# THE HOME WORKSHOP

MODEL MAKING : HOME WORKSHOP CHEMISTRY : THE SHIPSHAPE HOME



By looking into the device, you can see, as if projected on the paper, exactly what you wish to draw. All you need do is to trace the outlines carefully



## MAGIC *Sketching Spectacles*

By  
GAYLORD  
JOHNSON

Make It Possible for You to Draw Anything Accurately—Models, Objects, Landscapes, Portraits, or Copies of Plans and Photographs

**D**RAWING is the language of the mechanic. Whenever you set out to make anything more complicated than a shelf or a box, it is necessary either to sketch your own design or to use some other designer's mechanical drawings—drawings such as those illustrating so many of the articles in this department. In either case the information is given by means of lines and dimensions, not words. This explains why it is that every mechanic, whether amateur or professional, takes a keen interest in drawing, and why many of them are either skillful draftsmen or adept at making understandable sketches.

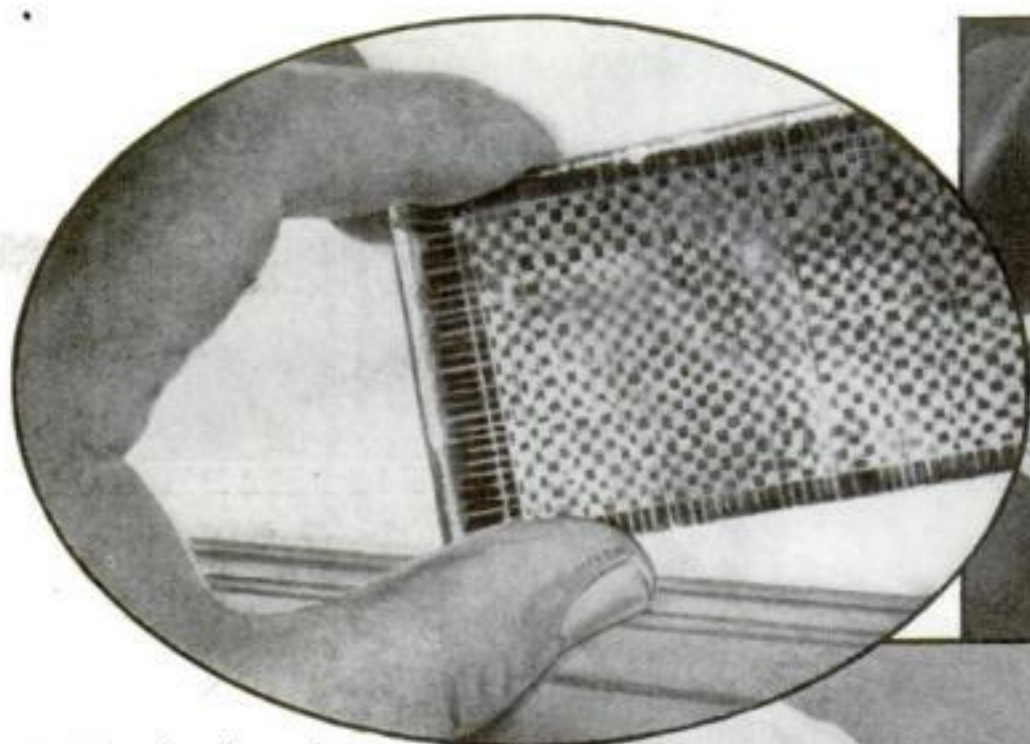
Not so many, however, can make a good free-hand perspective drawing from an object, a building, or a landscape, or can even copy pictures that involve a knowledge of perspective. Still more rarely is it possible for one not trained in art work to make a good, recognizable portrait sketch. Yet it is amazingly easy to do all of this with the aid of the device illustrated, which can best be described as "sketching spectacles." This instrument enables you to see what you want to draw as if projected right on the paper. All you have to do is to trace the outlines of the various parts with a pencil in order to draw everything just as it should

be—the shape, proportions, perspective, details, and light and shade.

The construction of the "spectacles" is explained in the drawings on the following page. The operation of the device depends upon the two mirrors *A* and *B*, placed in their boxlike container at the angles indicated, with their reflecting surfaces facing each other so that light will be reflected from one to the other.

The silvered coating of mirror *A* is continuous and unbroken, but part of the silver on mirror *B* has been scratched out in a pattern of tiny checkerboard squares, as shown in one of the photographs. This removes approximately half the mirror





The silvered surface of mirror *B* is divided into 1/16-in. squares, and the silver is scratched away from every other division

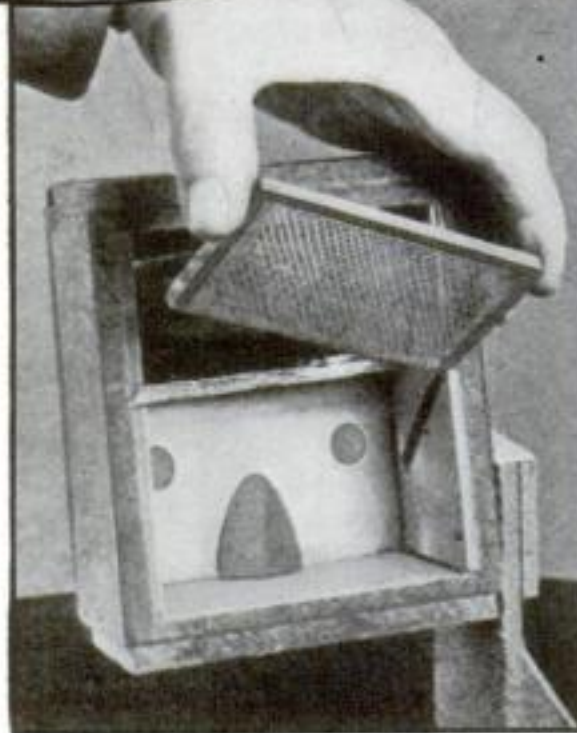
surface and allows the eye to see an object placed behind the mirror and, at the same time, the image of another object reflected from the tiny squares of silver that remain on the glass.

The application of this to sketching is made clear by the diagram. The course of a ray of light from the subject to be drawn is indicated by the line of heavy dashes. This ray meets the surface of mirror *A*, is reflected to one of the silvered squares on mirror *B*, and thence to your eye. The course of a ray of light from the pencil point to the eye is shown by the light dotted line. This ray goes straight through the clear glass of one of the scratched-out squares of mirror *B*. As a result, you see the pencil through the mirror image of your subject, and can trace the outlines of the image easily upon the paper. Later, you can finish your drawing in any way you please—for example, in pen and ink or water-colors—without the aid of the "spectacles."

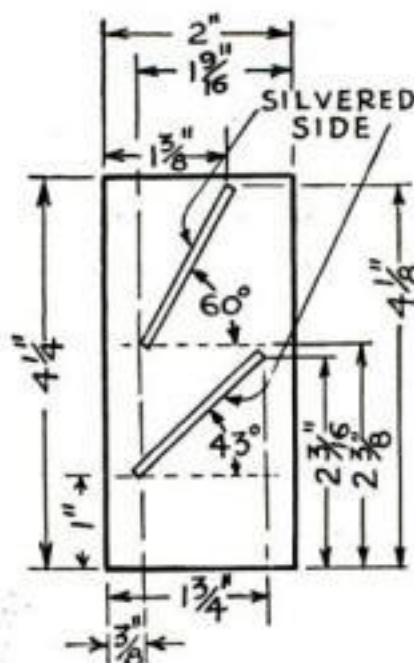
To insure accurate proportions, you should take care to place the drawing board at a slant, with its surface parallel to that of mirror *A*. Also, in sketching by artificial light, you must illuminate the pencil enough so that it is seen as distinctly as the subject to be drawn.

In the model illustrated, the box is made of composition fiber board except the two side linings in which the slots for the mirrors are cut and the front piece with the eyeholes and nose "bridge." These parts are cardboard. Wood could be used throughout.

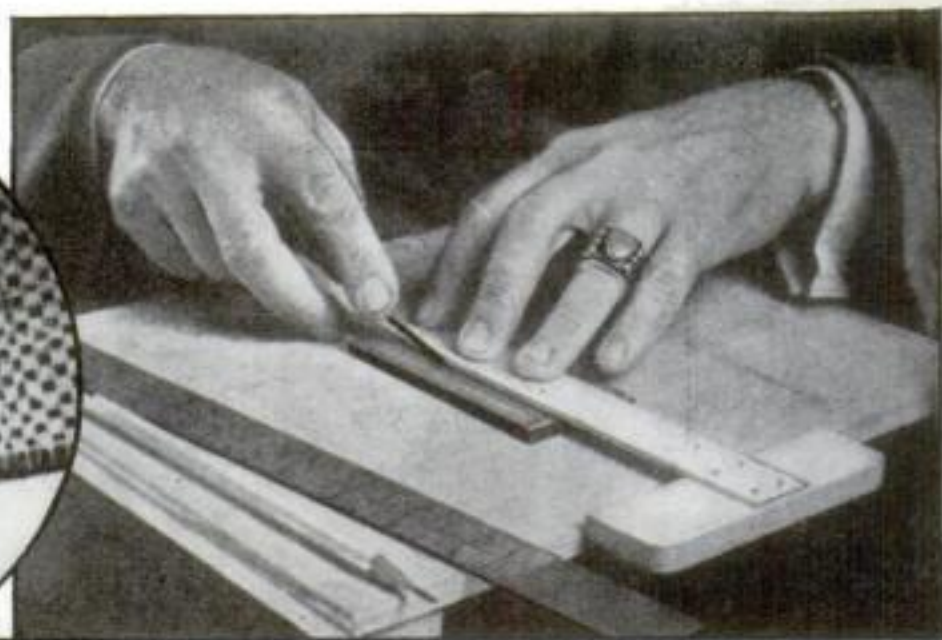
Mirror *B* was ruled in 1/16-in. squares. This is easy to do with a drawing board, T-square, and any sharp-pointed tool, such as the V-gouge of a set of carving tools. Then every other square can be scratched out with a penknife while the



The sketching box as it appears from the rear. Mirror *A* is in place and mirror *B* is about to be pushed into its grooves



How the mirrors are placed in relation to the inside of the box



Laying out squares on mirror *B* with a T-square and a small wood carver's V-gouge. Any sharp-pointed tool could be used

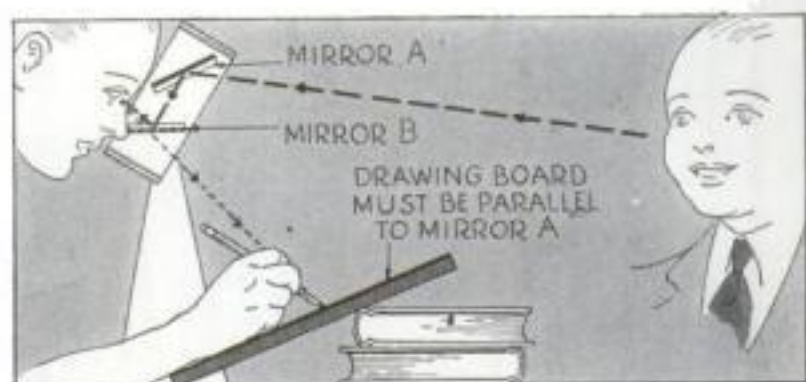
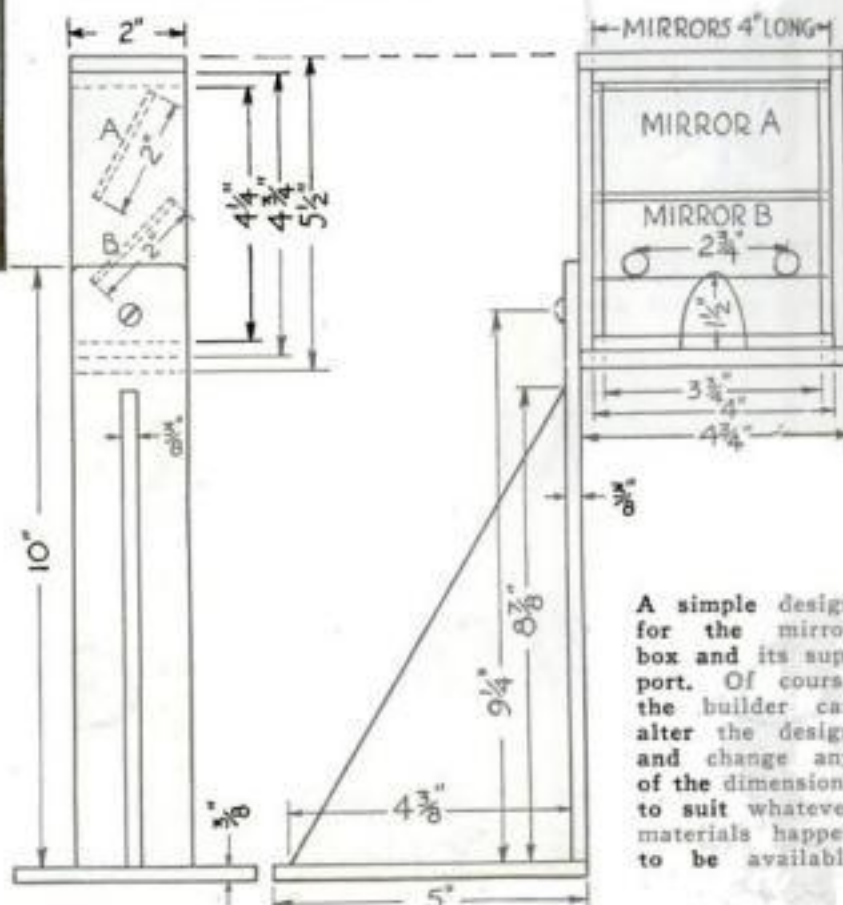


Diagram showing why the user is able to see a reflected image of the subject as well as the point of his pencil



A simple design for the mirror box and its support. Of course the builder can alter the design and change any of the dimensions to suit whatever materials happen to be available

## Last-Minute Gifts for CRAFTSMEN

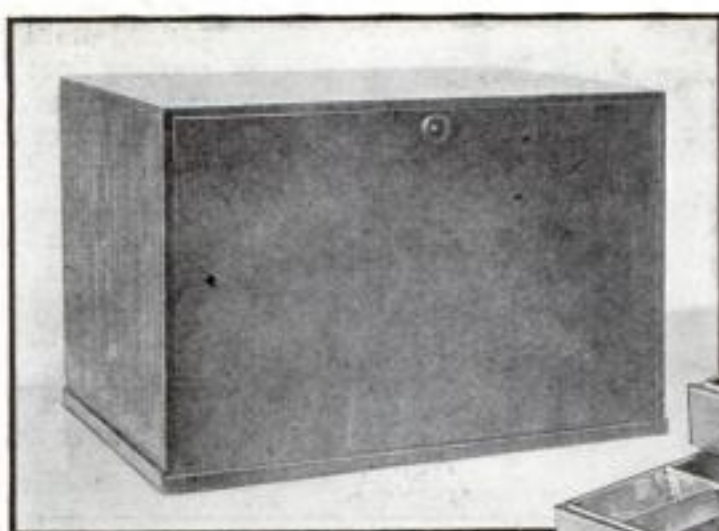
**YOU** cannot give an amateur craftsman anything that will please him better than one of the Popular Science Homecraft Guild construction kits listed on page 84. Three types are available—furniture kits with parts ready for assembly, kits containing only the raw materials for furniture, and kits for building beautiful ship models.



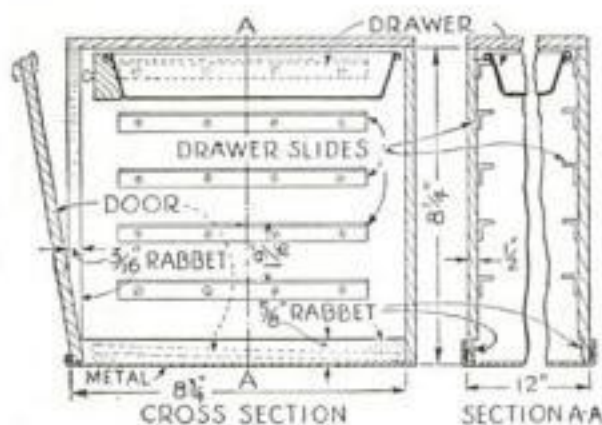
## Cabinet for Small Tools Has Drawers Made from Cake Tins

A CONVENIENT little chest of drawers or machinist's tool cabinet for your lathe tools, calipers, small files, and the like, or for brads, screws, and bolts, can be made by utilizing shallow cake tins from the five-and-ten-cent store. The cabinet illustrated was made from five of these pans and some odds and ends of material picked up about the shop. The top and front are  $3/16$ -in. pressed wood composition board, the back and ends  $1/2$ -in. pine from an old packing case, and the bottom galvanized iron from an old lawnmower's grass catcher. The bottom is bent up at the front edge to hold the door, which pulls out at the top and slides out of sight under the bottom drawer.

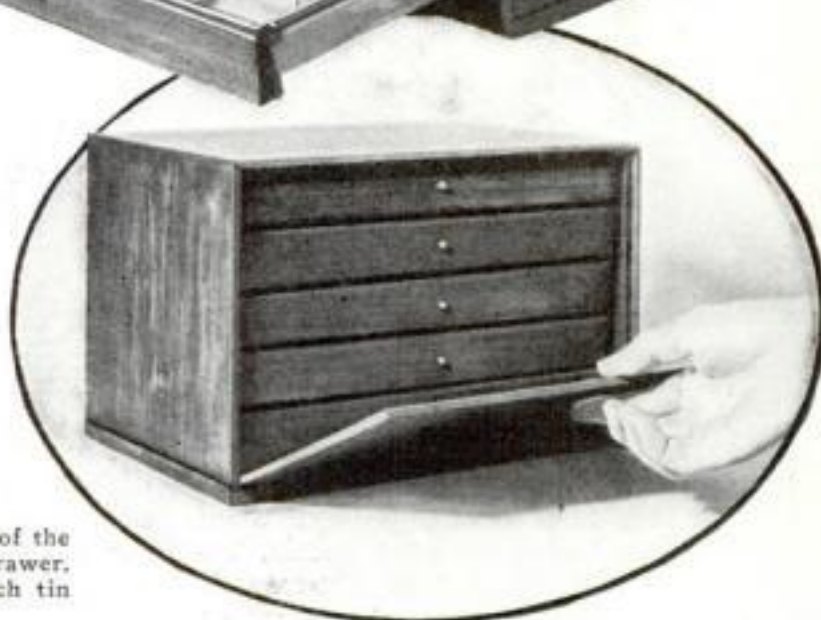
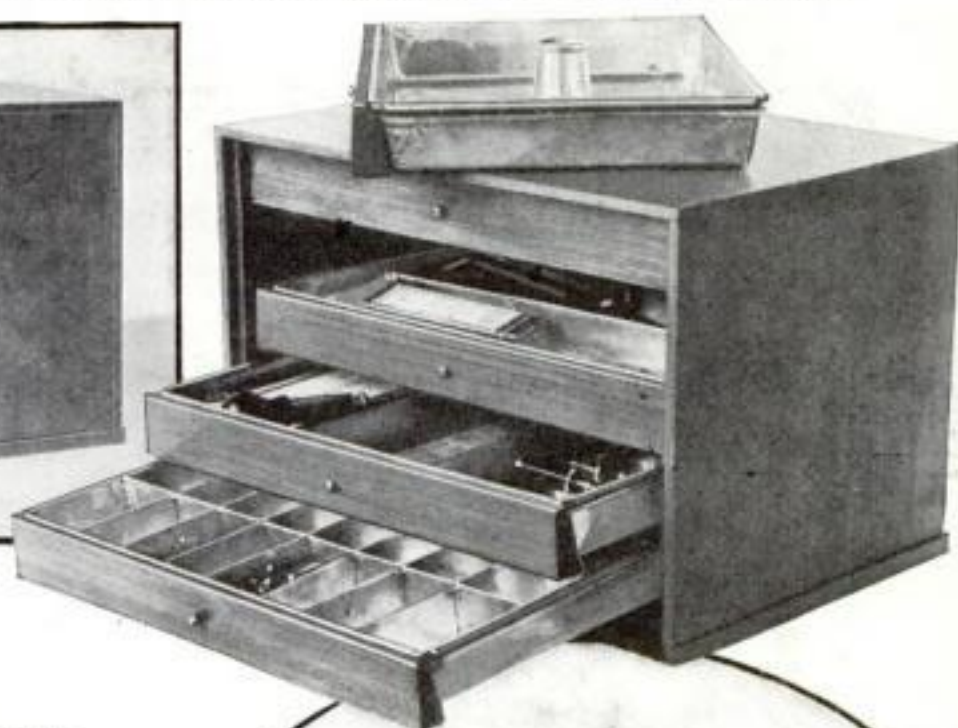
The drawing shows how the ends are rabbeted at the front and bottom, inside, to take the door and allow it to slide into the chest when it is open. The dimensions given are for tins  $13/8$  by  $7 3/16$  by  $10 15/16$  in. The drawer slides are merely metal strips bent at right angles and fastened to the inside ends with small screws. The rolled upper edges of the drawers slide on these, but it gives an increased bearing surface and



When the door is closed, it fits so snugly that the springy pressure of the top is sufficient to keep it up



Two photos and a drawing that show the arrangement of the drawers and how the door slides under the bottom drawer. A neat strip of wood is fastened to the front of each tin

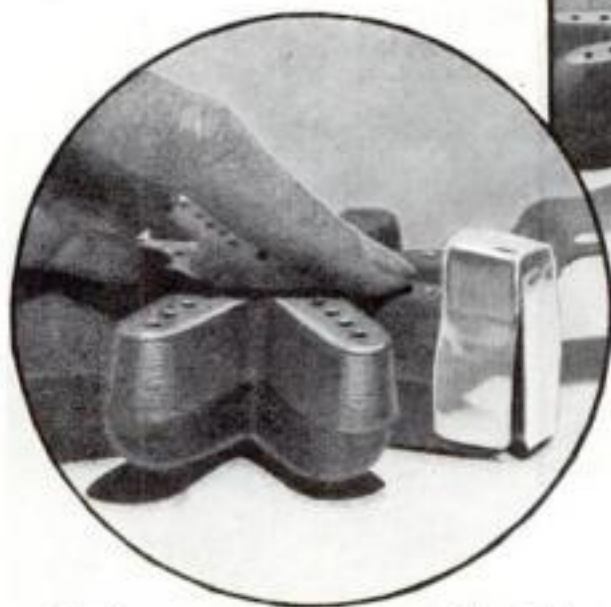


is stronger to solder a similar angle strip on the pan under the wire. The dimensions given allow  $1/2$  in. for the projection of the drawer-pull knobs, which can be made of metal or turned from wood. The bottom drawer is divided by soldered parti-

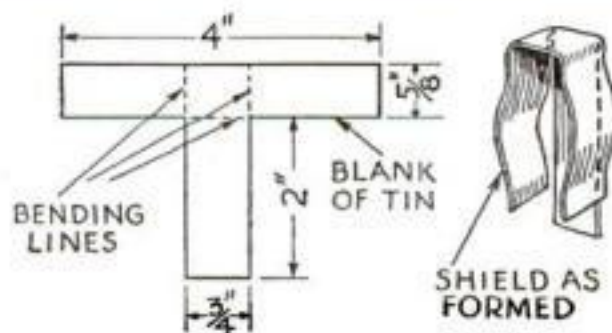
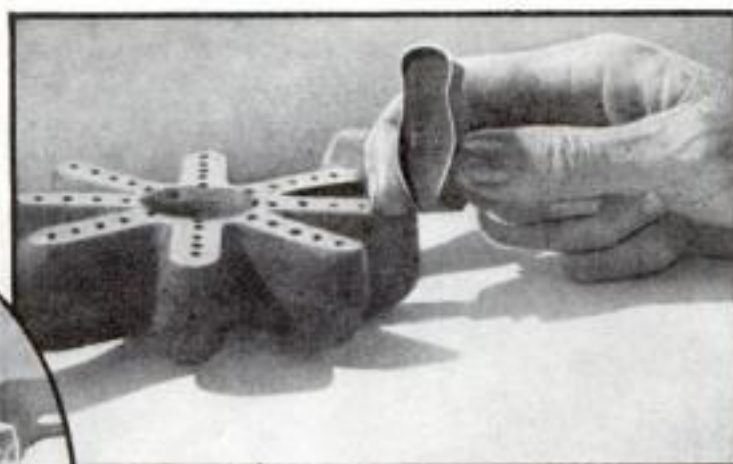
tions into twenty-four compartments. Those who do not wish to do this much soldering may accomplish the same result by using muffin tins. The shape of the wooden drawer fronts and other details are shown in the photos.—PORTER VARNEY.

## SHIELD KEEPS GAS FROM BLOWING OUT

The shield prevents a gas burner from being blown out by a sudden draft from an open door or window—an accident that usually fills the kitchen with gas and sometimes causes an explosion



GAS burners on stoves are often blown out without the user's knowledge. This danger may be removed by shielding two of the small holes in the burner so that they will relight the rest of the jet even though it is blown out. For the type of burner illustrated, the shield is constructed from a T-shaped piece of tin as shown in the diagram. This is bent so that it will



grip the sides of the burner firmly. For round or other varieties of burners, the shape and method of clamping can be modified as necessary. The back of the shield should face the direction from which there is most likelihood of a draft or gust of wind.—LEONARD MITCHELL.

## HOLDING SMALL OBJECTS WHILE PAINT DRIES

WHEN drying small parts that have been varnished, shellacked, or painted, it is always hard to find a convenient place to set them so that they will not be permanently marked where they come in contact with the surface on which they rest. To accomplish this, take a sheet of cardboard and through it stick a number of large thumb tacks in such a way that each of the painted objects can be rested lightly on three or four sharp points as shown in the illustration below. The points will leave no trace of their contact, and the air can circulate all around to facilitate the drying.—FRANK W. BENTLEY, JR.



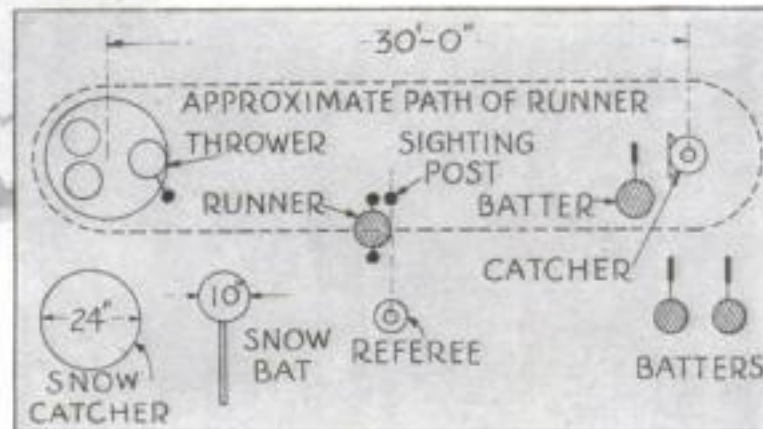
Thumb tacks pushed through cardboard support small, freshly painted objects while drying



# Fast and Exciting New Winter Game Played with Snowballs



The game can be played informally by any number, but the regulation contest requires two teams of four players each, arranged as in the diagram



**"SNOW bat,"** the latest in winter games, is an exciting variety of cold-weather baseball. The bat is a 10-in. disk of any thin, light material such as plywood, fiber board, pressed wood composition, metal, or even fabric. To this disk is fastened a handle that extends 20 in. In addition, a "snow catcher" or target is needed; this is a 24-in. disk with two short handles diametrically opposite each other. The cover of a bushel basket will do for making this.

One way to play the game is to allow the pitcher fifteen snowballs. His score is the number of hits he makes on the target, which is manoeuvred favorably by the catcher while the batter tries to intercept the balls with the bat. The catcher must hold the target by both handles at

all times. Any number may play, the game being something like scrub baseball.

The regulation game requires two teams of four players each. The team at bat consists of three batters and one runner; the team out, two snowball makers, a thrower, and a catcher. The players are stationed as shown in the accompanying diagram.

At the referee's signal the runner begins to run, and the thrower starts throwing at the target, which is manoeuvred favorably by the catcher. The batter intercepts the snowballs either with his body or, preferably, with the bat. The makers supply the thrower with snowballs as fast as he can throw them.

When a hit is made upon the target, the referee signals the hit, and play is sus-

pending until the runner returns to the starting line; then the second batter takes the place of the first batter, who is out. The thrower may also change places with a maker if desired.

Three outs, and the teams change places. One half hour constitutes a game; four games is a meet. The score for a game is the number of *complete* circuits made by the runners. The score for a meet is the number of games won.

The rules are as follows:

Thrower and makers must remain within an 8 ft. diameter circle. Thrower may throw only one ball at a time. A ball that splits or bursts in the air does not count. The thrower may use only one hand between hits for throwing. Time out may be called for a fresh supply of snow, but this should be done after a hit unless the interval between hits is unduly long.

The batter is untrammelled, except that he may not interfere with the catcher. The batters may change places at any time, at the discretion of the captain, by calling time out. Any batter may be substituted for the runner after a hit.

The runner may not interfere with any other player, and no other player may interfere with the runner. Runner must clear catcher and thrower's circle.

The catcher must keep the side of one foot against a short stake to limit his action. No hit scored with the foot off stake is allowed by the referee. The catcher must keep a hand on each handle of the target. Hits scored when thrower or catcher are infringing the rules are not allowed by the referee, who stands on a base, the better to observe the runner's score.

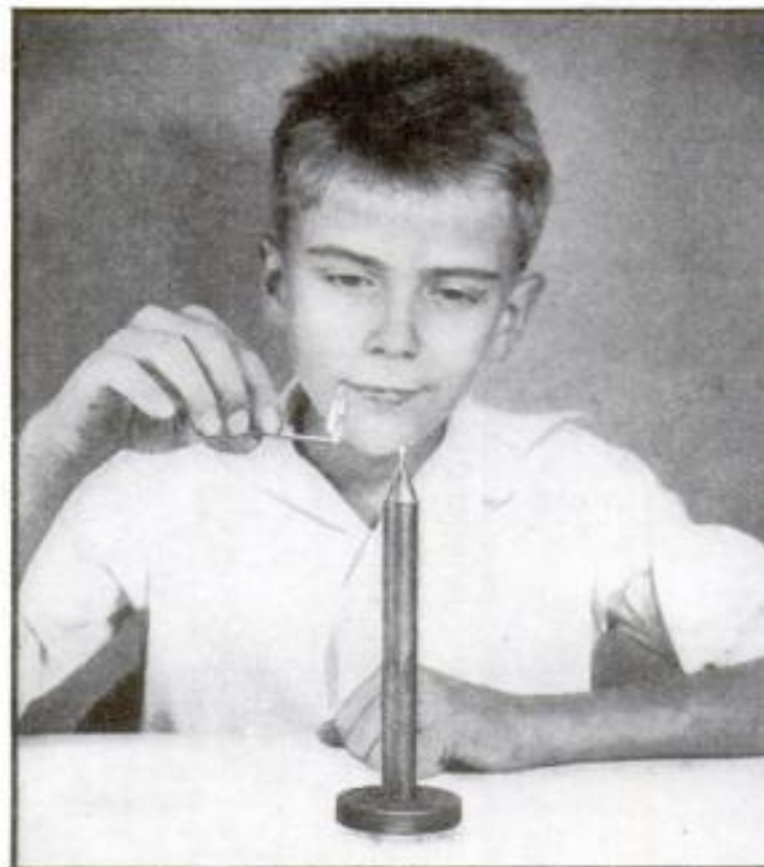
Ice skates may be worn if the game is played on a pond.—D. A. BUTLER.

## TRICK CHRISTMAS CANDLES SHOOT UP WHEN LIT

RED Christmas candles that will amaze and mystify the children can be prepared in such a way that when the wicks are lighted the outside, which is merely a shell, will shoot into the air and reveal a stick of candy. This is much more surprising and novel than an ordinary jack-in-the-box and is quite as safe.

Make the candles by rolling shiny red paper into a tube. Each tube fits over a stick of candy set in a hole in a 3 in. wooden disk, also enameled red. In the top of each tube, resting on the candy, is placed a coil spring tied up with a cord, and the ends of the cord project out of the top to form the wick. The cord is prepared in advance by dipping it into a hot, saturated solution of saltpeter with a little glue added. When the wick is lighted, it will burn down quickly and release the spring, and the candle shell will be shot high into the air.

A few candles prepared in this way will add to the gayety at any Christmas or New Year's party.—G. S. G.



Candy is hidden under the candle's shell





DONALD W. CLARK  
designs another  
simple new model

A Snappy Looking

# Sportster Monoplane

FOR model builders this little Gee Bee Sportster monoplane is an especially attractive design. If it is painted and trimmed as shown in the drawings, the finished model, even though it is rather small, will be what aviators call a "neat looking job." It has a wing spread of  $8\frac{1}{4}$  in., and the fuselage is  $5\frac{3}{8}$  in. long. In relation to the full size plane, the scale of the model is  $\frac{3}{8}$  in. equals 1 ft.

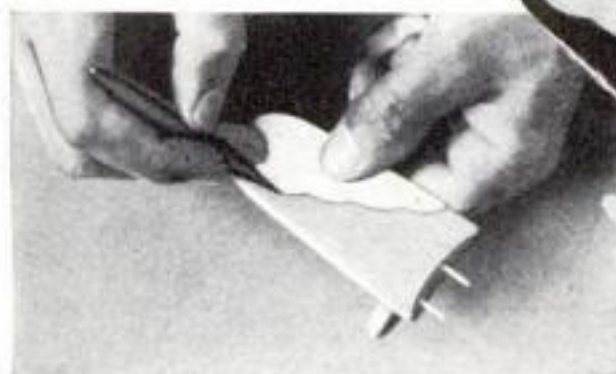
Only fifteen parts are needed. Cut the fuselage from a blank  $1\frac{1}{4}$  in. in diameter by  $5\frac{3}{8}$  in. long (a section of wooden curtain pole will do). Saw the two slots in the tail end before shaping. Drive four thin brads into the sides of the body where marked and snip off the heads.

Cut out the propeller and the nose plate from thin aluminum and the wheel struts from heavier stock.

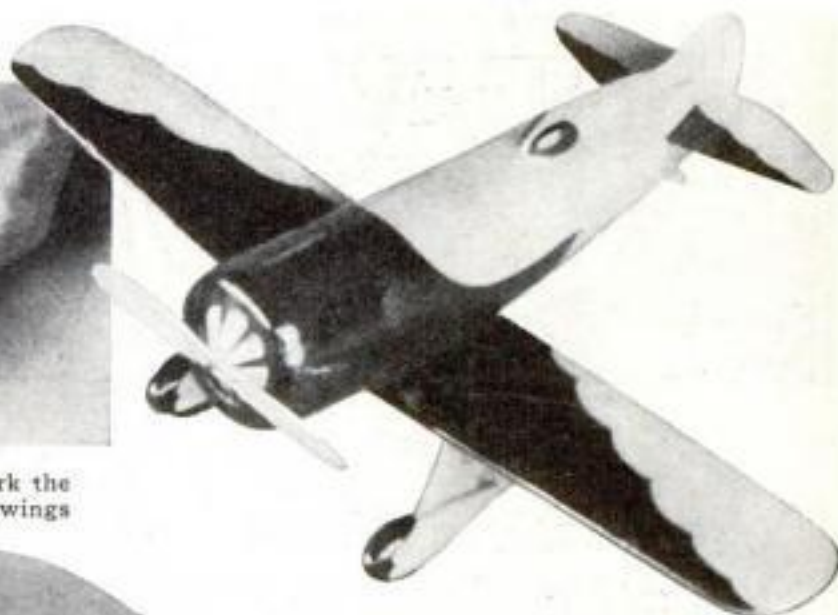
For the wings saw out a pine blank  $\frac{3}{16}$  by  $1\frac{5}{8}$  by  $7\frac{5}{8}$  in. Cut this in the middle and shape to the form shown. Drill holes to receive the brads in the fuselage.

Carve the wheel "pants" from pine blanks  $\frac{1}{4}$  by  $\frac{1}{2}$  by  $1\frac{5}{8}$  in. Saw the strut slots before shaping, and drill holes for brads. Make one wheel, saw it in two, and fit the halves to the bottom of the "pants" with a half-round file.

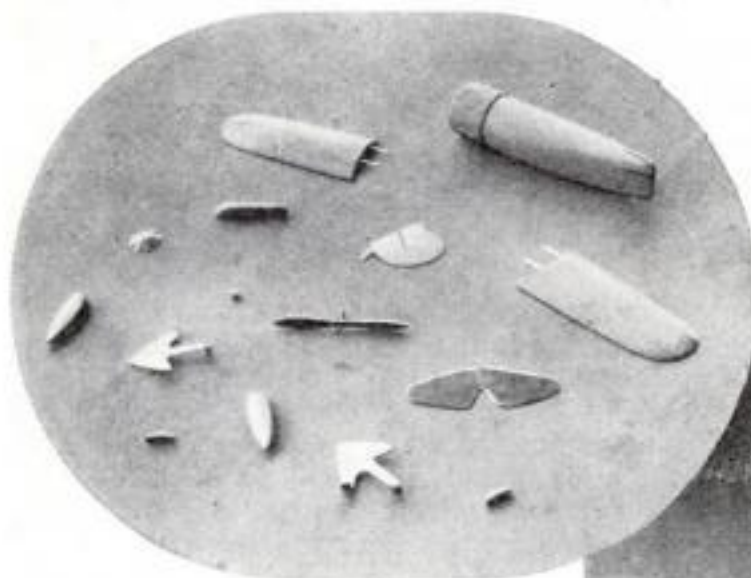
Whittle the cockpit hood from a pine blank  $\frac{5}{16}$  by  $\frac{3}{8}$  by  $1\frac{3}{4}$  in. Saw a slot in the rear end to fit onto the vertical tail unit. Fasten the hood with glue.



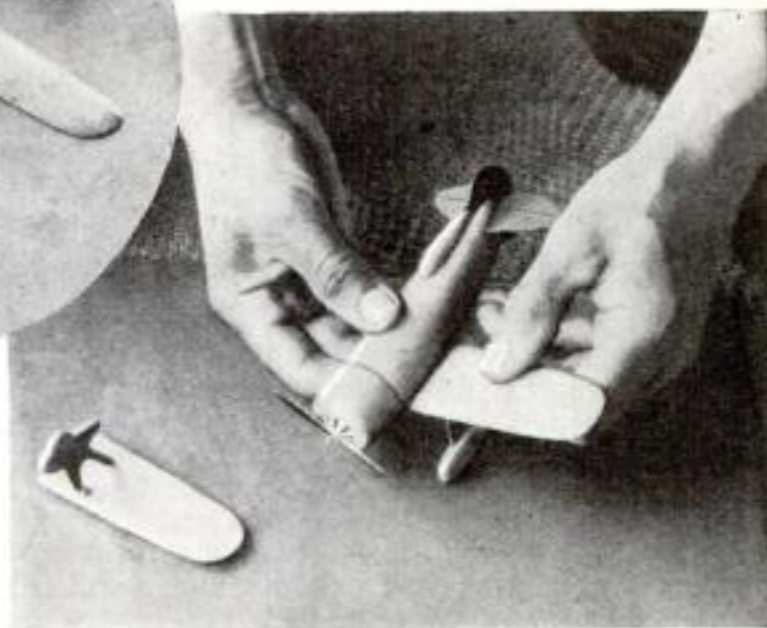
Using a cut-out paper pattern to mark the scalloped ornamentation on one of the wings



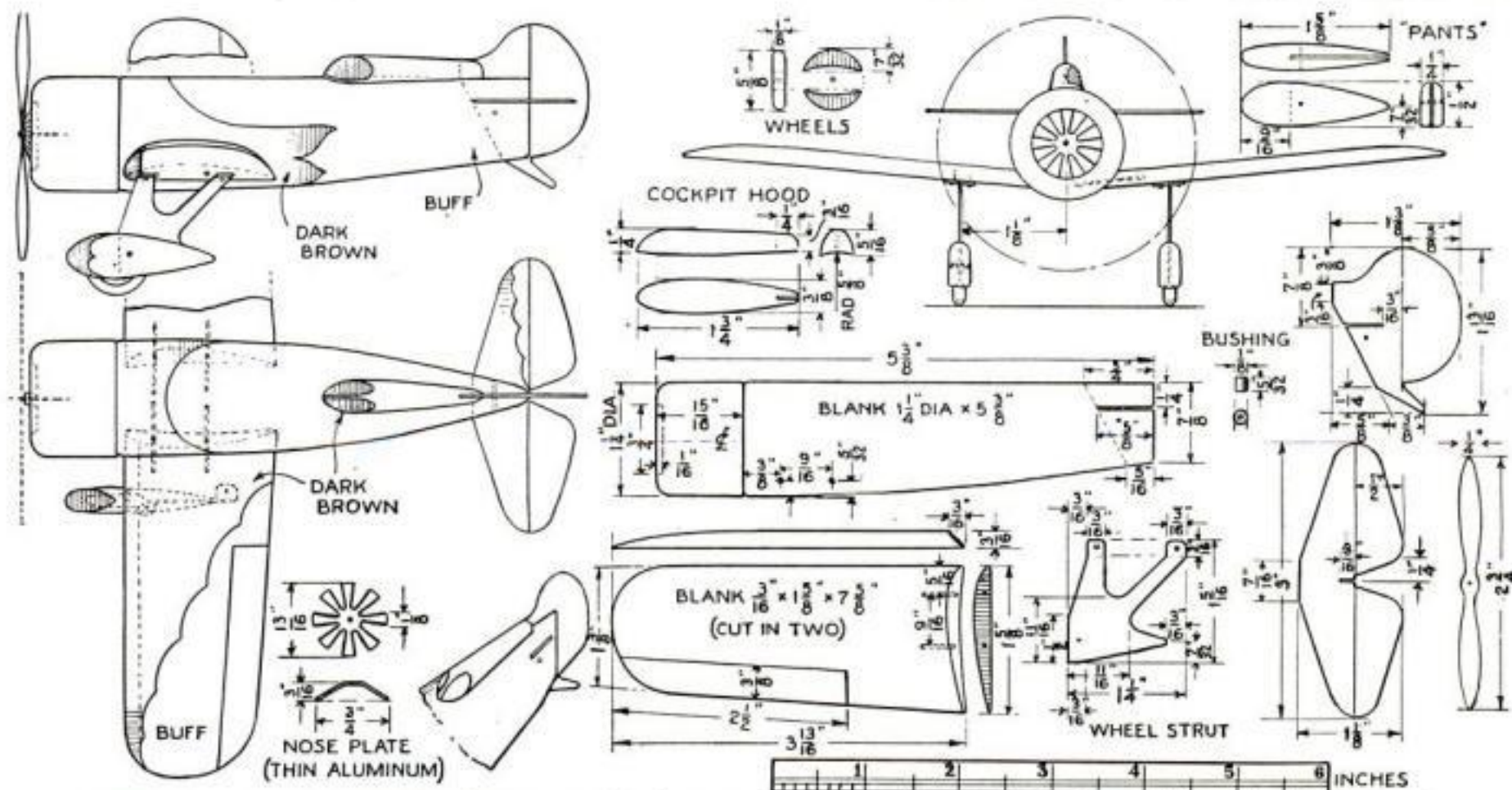
When painted as attractively as this, the model appears much more complicated and difficult to make than it really is



The parts before assembly. The fuselage is shaped from a piece  $1\frac{1}{4}$  in. in diameter. A section of wooden curtain pole will do



The wings are fastened to the fuselage by means of thin brads from which the heads have been cut off. These serve as dowels



Working drawings of the Gee Bee Sportster model. Any measurements not indicated can be found easily by using the inch scale



# How to build the latest type of *Racing* ICE YACHT

*New, simplified plans that will enable you to enjoy at low cost one of the most thrilling winter sports—A boat with a 20-foot backbone*

By

ALVIN M. YOUNGQUIST

**S**KIMMING over a glazed stretch of ice at forty or fifty miles an hour in an ice yacht—there's breath-taking sport for you! A violent gust drives the yacht forward in a new burst of speed, the windward runner lifts clear of the ice, and you are in the midst of a tense and thrilling struggle to prevent capsizing. But that only adds zest to your flight. The keenness of the sport lies in matching your skill against the strength and trickiness of the wind.

If you do the work yourself, you can build an ice boat of the latest design for from \$35 to \$50. The yacht illustrated—the *Comet*—was designed especially for the club racing of the Western Michigan Yachting Association. These 150-ft. (sail area) ice boats offer the keenest kind of competition in class racing. They are easily assembled and come apart in units convenient for transportation and storage. They can be handled without difficulty under sail, and their performance compares favorably with larger yachts costing twice as much.

The two most important members of the ice boat body are the running or runner plank (cross timber) and the backbone (fore-and-aft timber). The runner

plank must be strong but not too stiff, as some spring in it is desirable. Clear edge-grained western fir 2½ by 10 in. by 12 ft. makes a satisfactory running plank. To save weight and to give greater spring, the plank may be tapered to 1¾ in. in thickness at the ends, but this is not essential, and if tapering its thickness is done by hand the labor involved is considerable. If, however, the plank is tapered, it should all be cut from the top side, the bottom being left straight.

The backbone is also of fir, although spruce or white pine may be used for the ¾ in. thick sidepieces. Because of its greater length, this part is made hollow to save weight. Two centerpieces 1½ by 2½ by 20 ft. and two sidepieces ¾ by 5½ by 20 ft. long are required. As long stock is more expensive to buy, the ¾-in. sidepieces may be made of shorter stock without appreciably weakening the timber. In this case there should be two pieces to a side, spliced over a block, the butt joints being staggered. The bottom 1½ by 2½ in. piece is first secured to one side board

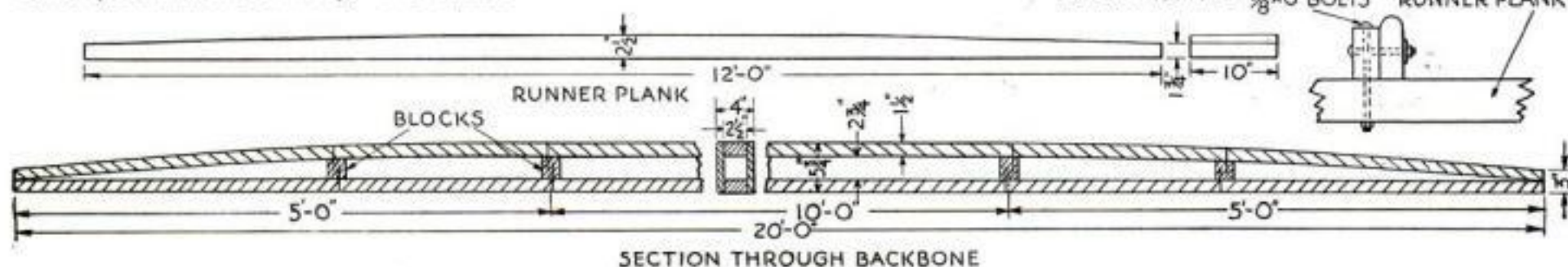
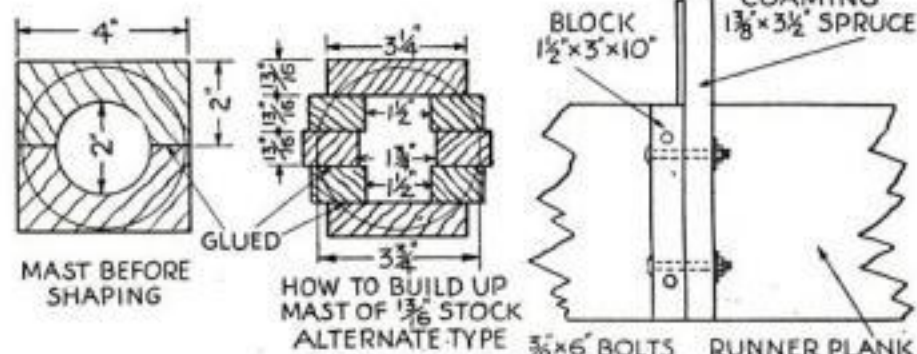
with waterproof casein glue and eight-penny nails or screws. If clamps or weights are available, the glue fastening will be all the better, and fewer nails need be used. Next bend the upper 1½ by 2½ in. piece over blocks conveniently spaced so that it meets the lower centerpiece at both ends and is raised about 2¾ in. for a parallel distance of about 10 ft. at the center of the backbone length. Then fasten it to the sidepiece with glue and nails. When the glue has hardened, fasten the second sidepiece to the part already assembled. Plane away those parts of the sidepieces that project above the tapered ends, set the nails, and fill the holes with a plastic wood composition or other filler. Sandpaper the whole smooth, ready for the finish.

The backbone is fastened to the running plank by 13 by 1¼ by ¼ in. diagonal steel straps and two 10 by ½ in. hexagonal head bolts. Two small brace blocks are screwed to the underside of the backbone on each side of the runner plank.

The cockpit sides or coamings and the stern piece or transom are made of ¾ by

## MAST, BACKBONE, RUNNER PLANK

Details of principal wooden parts. The design of the ice yacht was worked out by a committee of experts under the chairmanship of Mr. Youngquist, who is a naval architect



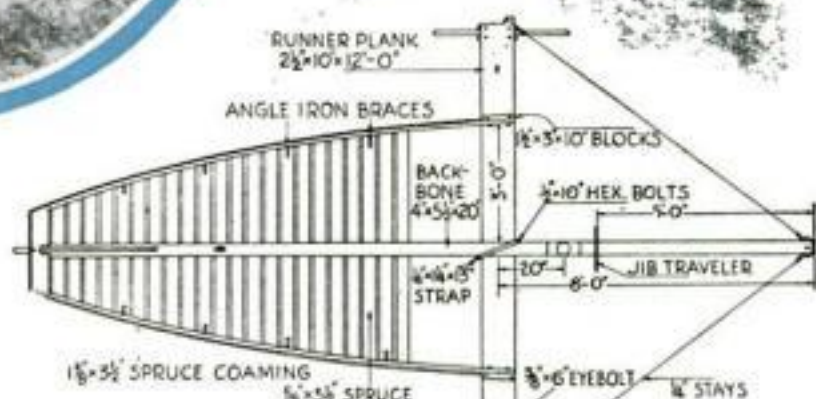


3½ in. oak or 1⅝ by 3½ in. spruce. The bottom or floor boards are made of ⅝ by 6 in. spruce or pine spaced 1 in. apart and screwed to the sides and backbone with 1½-in. No. 10 wood screws. The drawings show clearly how the cockpit parts are fitted and assembled.

The mast may be made of a solid piece of spruce 4 by 4 in. by 20 ft., or of two pieces of spruce 2 by 4 in. by 20 ft. glued together, or of several ¾-in. pieces glued together as shown on the drawing, depend-

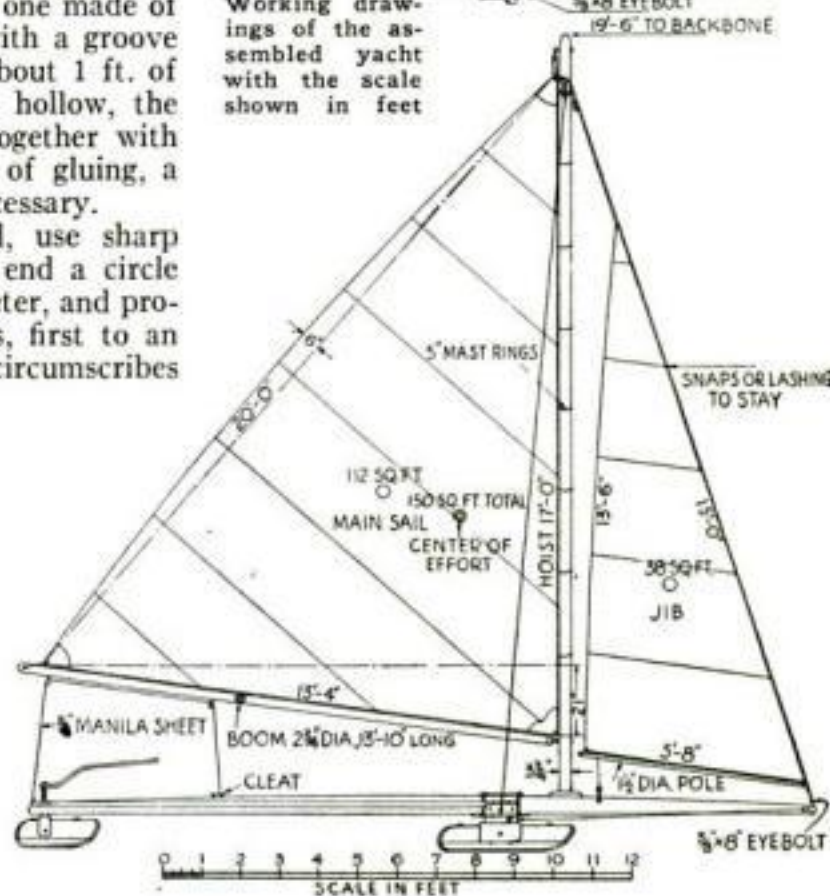


The ice yacht under sail. In circle: How the cockpit is floored. At left: Fastening coaming to the runner plank.



#### PLANS

Working drawings of the assembled yacht with the scale shown in feet



## BILL OF MATERIALS

### Lumber

- 1 pc. 2½" x 10" x 12' fir for runner plank
- 2 pc. 1½" x 2½" x 20' fir for backbone
- 2 pc. ¾" x 6" x 20' spruce for backbone
- 2 pc. 1⅝" x 3½" x 12'-4" spruce for cockpit sides
- 90 linear ft. ⅝" x 6" (5½") spruce for cockpit bottom
- 4 pc. 1½" x 6" x 12" oak or yellow pine for chock blocks
- 2 pc. 1½" x 5" x 3'-6" oak for runner tops
- 1 pc. 1½" x 5" x 2'-2" oak for rudder top
- 2 pc. 2" x 4" x 20' spruce for mast (or 1 pc. 4" x 4" x 20' for a solid mast)
- 2 pc. 1½" x 3" x 14' spruce for boom
- 1 pole 1½" in dia. x 5'-10"
- 1 pc. 1½" x 4" x 10" oak for mast step

### Hardware and Rigging

- Galvanized eyebolts: 4—6" x ⅝" for stays; 3—8" x ⅝" for stays; 2—5" x 5/16" on mast
- Carriage bolts: 4—6" x ⅝" for fastening coaming blocks to runner plank; 8—8" x 7/16" for runner chocks; 4—3½" x ⅝" for fastening coaming to blocks
- Hexagonal head bolts: 2—6" x ½" for runners; 1—3½" x ½" for rudder; 2—10" x ½" for straps fastening backbone to runner plank; 8 tap bolts 6" x ½" for fastening shoes to oak tops
- 6—3" angle irons for cockpit sides
- 2 steel straps 13" x 1¼" x ¼"
- Miscellaneous wood screws and washers for bolts
- 90' of ¼" galvanized stay wire
- 120' of ⅝" manila rope
- 7—¼" galvanized wire thimbles
- 4—⅝" galvanized rope pulleys
- 8 wood or iron mast rings, 5" in diameter
- 1 ball of lashing cord
- 2—5" galvanized cleats

### Blacksmith Work

- Rudder fork and tiller
- Stem piece
- Jib sheet traveler

### Foundry Work

- 3 cast-iron runner shoes

### Finishing Materials

- 1 qt. white shellac
- 2 qt. outside spar varnish

### Sails

- 8-oz. main sail, area 112 square feet
- 8-oz. jib, area 38 square feet
- 1—8-oz. waterproof sail cover

ing on the material available in your local lumberyard. The best mast is one made of two pieces each 2 by 4 in. with a groove cut in each piece to within about 1 ft. of each end to make the mast hollow, the parts being carefully glued together with casein glue. For a good job of gluing, a dozen or more clamps are necessary.

To make the mast round, use sharp dividers to inscribe on each end a circle of the required finished diameter, and proceed to plane off the corners, first to an approximate octagon that circumscribes the guide circles. Then cut the eight corners or edges down to the circles.

The boom is made in the same manner, either of one piece or of glued-up stock, but it need not be hollow.

Apply a thin priming coat of white shellac, followed by two or three coats of spar varnish.

*How to complete the ice yacht will be told in the next issue.*

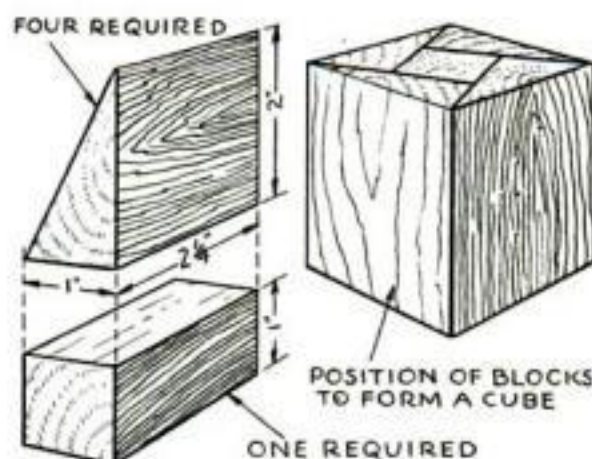
## FIVE BLOCKS FORM DECEPTIVE PUZZLE

A PUZZLE that is simple in solution, but more confusing than may appear to those unfamiliar with it, can be made of five blocks as shown in the accompanying drawings. Four of these are wedge-shaped and measure 1 by 2 in., the length being equal to the hypotenuse side of the triangle—slightly less than 2¼ in., or 2.236+ to be more exact. The other block is 1 in. square, and its length also is nearly 2¼ in.

The five blocks

may be placed together to form a perfect cube as indicated. They may also be placed to form a piece 1 by 2¼ by 5 in. This is easier than forming the cube.

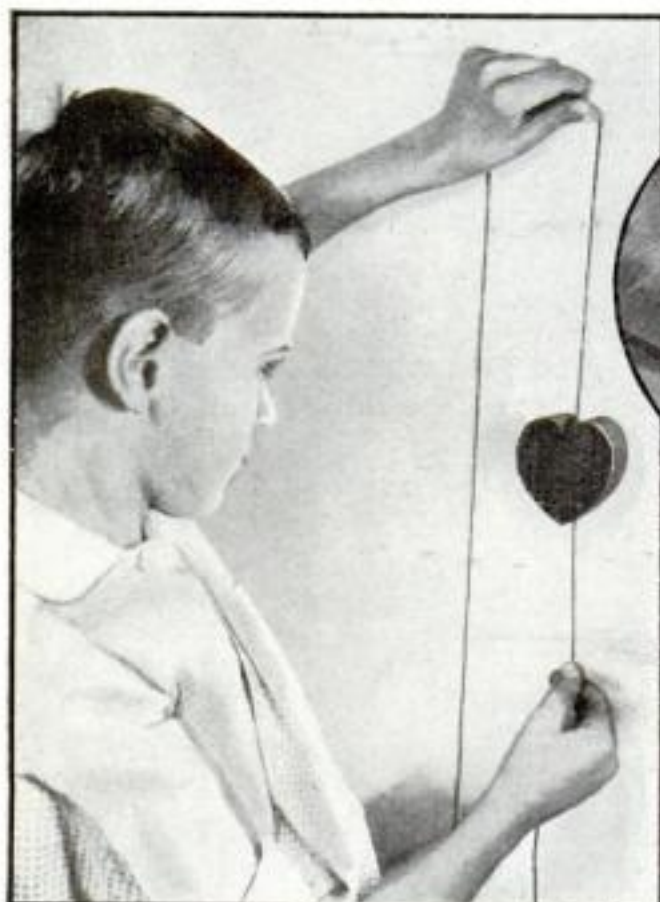
The making of the blocks so that they fit accurately and form a perfect cube, is an excellent exercise in manual training, and the finished puzzle will amuse the grown-ups as well as the children. Walnut or mahogany is an excellent wood to use.—A. L. S.



How the blocks are shaped and assembled. Making them accurately is a test of skill.



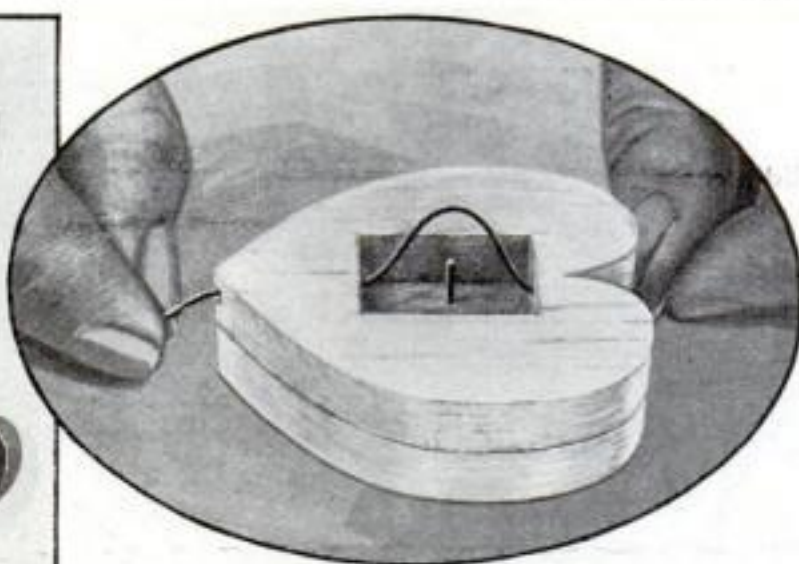
# Traveling Heart Trick Looks Familiar but Fools Everyone



The performer can make the wooden heart stop where he wishes simply by pulling the cord taut.

THIS traveling heart, which looks like an old and familiar trick, is a good one for turning the laugh on those who always think they know how such things are done.

A red wooden heart with a hole running



The heart with one of the sidepieces removed. The trick can be done only when the cord is pushed from both ends into the opening and looped over the nail.

through it is strung on a cord held in the performer's hands and will travel down the cord and stop wherever he wishes. Wise ones know that this is caused by pulling the cord taut, but when they try to show how it is done, the trick will not work.

The heart is scroll-sawed from three pieces of wood, and an opening is cut in the center of the middle one. It is through this part that the vertical hole for the cord is drilled. At one side of where the cord passes through, a small brad is driven as shown into one of the outside pieces. The cord is waxed to make it stiff. By pushing an inch or so of it into the

heart a loop will be formed within the cut-out space as indicated; then, by twisting the cord between the fingers, the loop may be made to fall over the brad. The parts are glued together, sanded, and enameled or lacquered red.

Whenever the performer draws the cord taut, the heart will stop on the cord. Before handing it to a spectator, however, he pushes the cord into the heart and twists it in the opposite direction from that in which it was originally twisted so that it will become disengaged from the brad. The cord then runs straight through the heart, and no one can do the

trick successfully. After trying in vain to stop the heart by pulling the cord taut, the person who is not in the secret will attempt a variety of manipulations, but all will fail.—KENNETH MURRAY.

## ALUMINUM RAZOR HONE

WHEN spread on a clean razor strop, aluminum powder, or aluminum bronze as it is often called, imparts an exceedingly keen edge to a razor blade, according to an investigation recently made by a German engineer. To make this test, first rub soap on the strop, then spread a thin coat of the aluminum powder.—E. W.

## WOODEN FLOWERS FORM NOVEL BOUQUET

ARTIFICIAL flowers are again in vogue, especially fanciful designs in metal. Equally decorative flowers, however, can be fashioned from wood with a lathe and a jig saw.

Turn a hardwood cylinder 2 in. in diameter and 8 in. long. Mark off the lengths of the three blossoms, as shown in the accompanying drawing. Leave  $\frac{1}{4}$  in. between each for cutting off, and turn to shape. The sepals, it will be noticed, curl upward a little at the tips, and are considerably undercut, completing the line of the petals. The tips of the petals turn out also, but are only slightly undercut.

Sand the blossoms and cut them off. Divide the sepals into five parts, estimating with the eye, and cut in the divisions with a coping saw. Trim from both sides with a chisel or knife, and gouge the sepals out on both sides of the center veins. Cut out the divisions between with a V-tool or  $\frac{1}{8}$ -in. gouge.

With the same tool incise the divisions between the petals. The tips of the petals are double-pointed, with an inverted V-cut between.

Lay out the side curves of the leaves on  $\frac{3}{4}$ -in. stock, and after cutting them outline the edges, making some curve to the right and some to the left. Round the convex sides on a sanding drum, and cut grooves in the lower ends to fit the stems. Use baling wire for the stems.

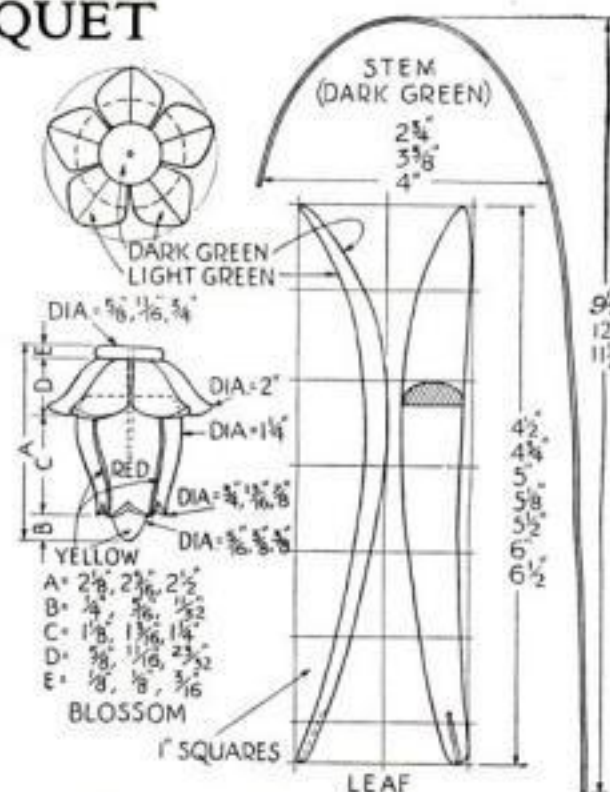
Choose a slender vase for the flowers. If the neck is not fairly small, cut a wooden disk to fit and pierce it with three small holes, through which the stems are thrust. Bind the lower ends of the stems

with wire, and arrange in the vase. Tie the leaves with wire, sliding them around or up and down until an effective grouping is achieved, when they can be glued.

Paint the stems with enamel or lacquer. Color the convex sides of the leaves and



The completed bouquet has three stems and flowers and seven leaves of different sizes.



Suggested dimensions for the various parts. The one leaf shown is the longest of the set.

one side of each sepal dark green, use light green for the other sides, make the petals red and the flower tips yellow, and add dashes of yellow in the petal divisions just below the sepals.—EDWIN M. LOVE.

## CUTTING ROUND GASKETS

CIRCULAR gaskets of rubber, cork, and various compositions can be cut with a tool made from an old pair of heavy steel dividers. Heat one leg of the dividers, flatten it like a knife, and temper and sharpen it.—ARCHIE AMOS.



EDWIN M. LOVE, noted craftsman, shows

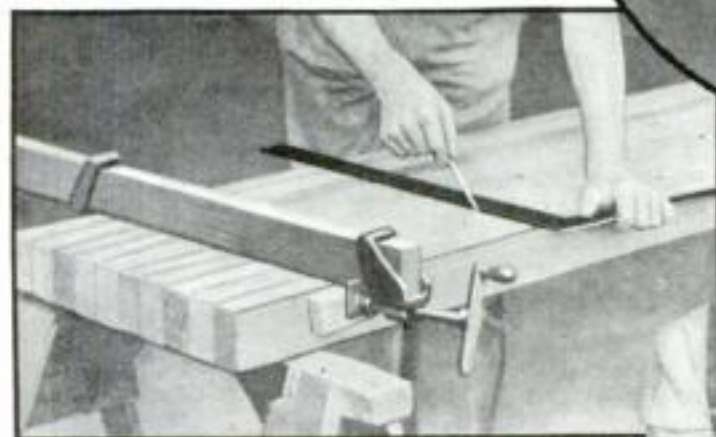
# How to Glue Up a Perfect Bench Top

Nearly all the necessary planing can be done on a small home-shop jointer

**A** PLANK makes a poor cabinetmaker's bench top, for it wears rough, lacks rigidity, and persists in warping. A top glued up from strips is far more satisfactory.

Maple, birch, and apiton, which closely resembles Philippine mahogany yet is harder than oak, are excellent. For a top 18 in. wide, obtain ten rough 2 by 3 in. pieces. Lay them on sawhorses, choose the best ends for the front, and by inspection of the end grain, determine the heart (inner) and sap (outer) edges. Turn the 2 by 3's so that heart and sap alternate.

To detect wind or twist in the pieces, lay them on a convenient support and sight over parallel edged wooden strips resting on the ends. When roughing a piece on a small power jointer, be sure to hold it so that the high corner will be removed. Turn end for end and repeat. Then run the piece full length until it is straight, or if it is sprung, until the curve is uniform throughout. Use a hand plane



When jointed, clamp the pieces together and square lines across for bolt holes

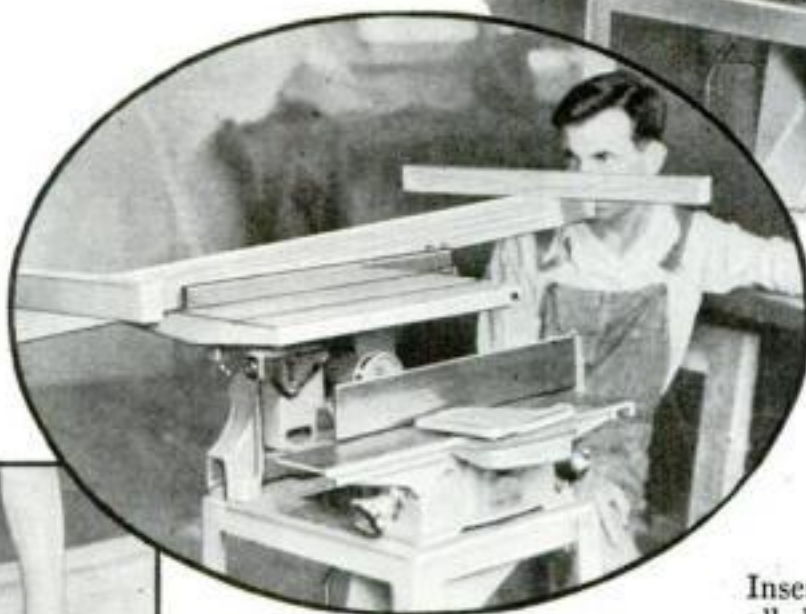
to take off the ribs left by the machine, with an extra shaving out of the center so that the edges will be forced tightly together.

Joint the better edge, gage both edges for the greatest thickness of the material, and plane off to the line. Do this with all pieces, clamping them together two at a time, in succession, to see if the joints are good. Finally clamp all ten together so that lines can be squared across for locating the bolts. Number the front ends before taking them apart.

Square across the faces of the pieces at the bolt locations, and scratch short lines across these, gaging from the upper edges in all cases. Mark the intersections by pricking deeply with an awl. Bore the holes with a  $\frac{3}{8}$ -in. bit.

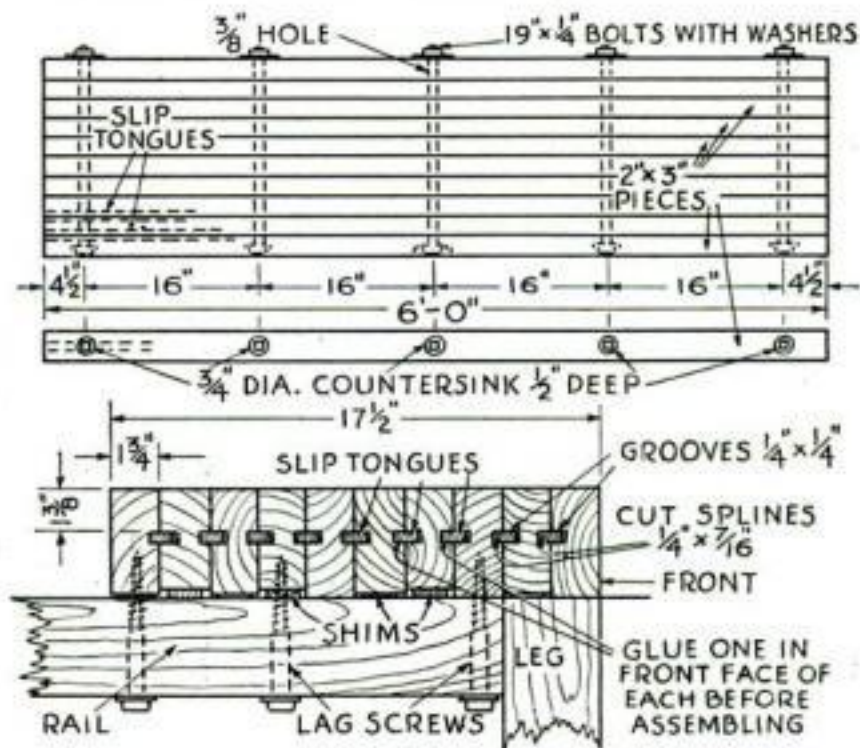


In grooving the pieces, a block is clamped behind the fence to keep it from springing



To find out if the stock is twisted, place parallel edged wooden strips or straightedges across it at both ends and sight over them as shown above

The glued top is also tested for any twist or wind, and then dressed level by planing it diagonally. Below: The drawings



If a power dado is at hand, groove the joining faces for slip tongues in such a way that the pieces will go together with the top edges flush.

Slow-setting casein glue is probably the best—a mixture of 15 oz. water with 8 oz. of the adhesive. Coat all of the joining surfaces.

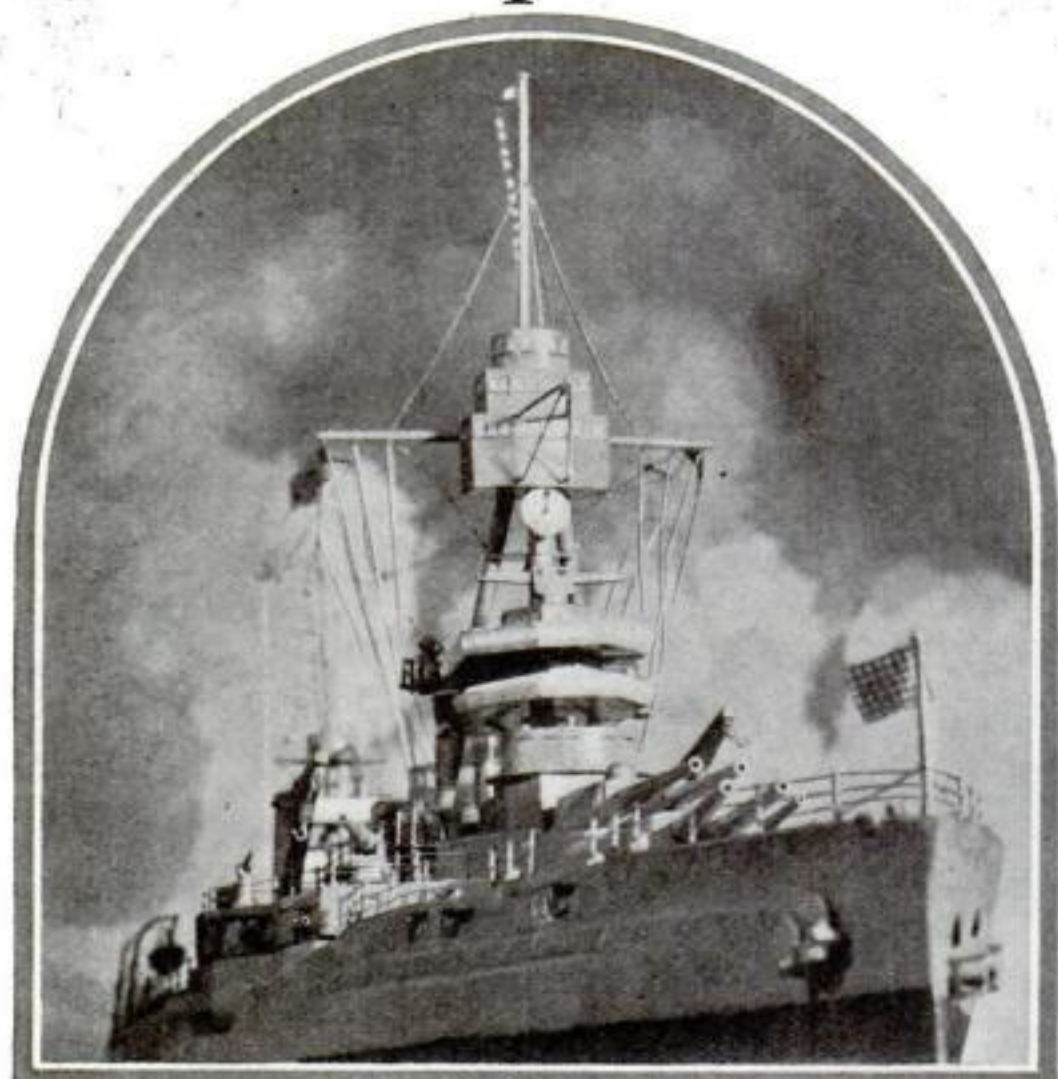
Insert and tighten the bolts; then apply all bar clamps at hand, alternately on one side and the other. If the assembly cups, clamp stiff slabs across the ends to hold them flat. Group the bar clamps around a bolt and tighten it; then move the clamps to the next. Finally, distribute the clamps and let the top dry.

Test the top for wind, and dress it to a level surface by planing diagonally with a jointer plane. Then plane it with the grain, scrape and sand it smooth, and apply three coats of hot linseed oil.

Mount the top with lag screws from underneath. Lock the front edge solid, but make rectangular holes for the other screws to allow a slight movement.



# Picturesque Deck Structures make our Battleship Model more warlike



By Capt. E. Armitage McCann

**O**UR new 3-ft. model of the United States battleship *Texas* has been carried in previous installments (P. S. M., Nov. '32, p. 67, and Dec., p. 71) to the point where the tripod of the foremast is in place, capped, as it were, by the main battery control station.

The *Texas* is one of the most powerful battleships afloat. How high she ranks among American ships is indicated by the fact that she is the flagship of Battleship Division 1 of Battle Force, U. S. Fleet. She is therefore a particularly good subject for the model maker and can be built with equal satisfaction as an exhibition model for display purposes or as a power-driven working model.

Resting on the main battery control station, which is marked 33 in the drawings published last month, are the secondary battle top (34) and the main battery and direction top (35). On all three (33, 34, and 35) I merely painted the windows.

Underneath this structure there is a platform (32), cut to fit half around each leg of the tripod. This platform and the other deck can be kept in position by driving pin points into the struts. From the platform hangs the bell (37), about  $\frac{1}{8}$  in. in diameter.

Vertically under the front edge of 33 there is a clock with one black hand and black figures 1 to 10, called the "concentration dial." This is a thin sheet of brass with an arm soldered onto the back and nailed to the tripod (see 36a).

Abaft the tops are the yard (38) and the mast (39). These are fastened to the back with staples. In front there is a forked wire (40) with the ends driven in-

to the top edge of 33, and to the end of it is soldered another thinner forked wire with its ends set into the bottom of 33.

The mast proper and the signal mast, or topmast, are made in one. It is stayed with a thin wire from the position shown, having six very small beads rove on. The wire is soldered into a hole at the point of the forked wires (40). The breast stay, which comes from the same position, has six beads, passes through a hole in the yard, has six more beads, and is fastened to a staple in the tripod—on both sides, of course. A touch of glue will hold the beads in their proper positions.

**AT THE** top of the signal mast there may be either a plain glass bead, representing a light, or an ordinary truck, which had better be left off until the flag goes up.

The projections at the side of deck 20 are for ladders, metal or wood, with No. 24 brass wire posts and a handrail bent to shape and soldered to the rail stanchions.

These rail stanchions should be the two-

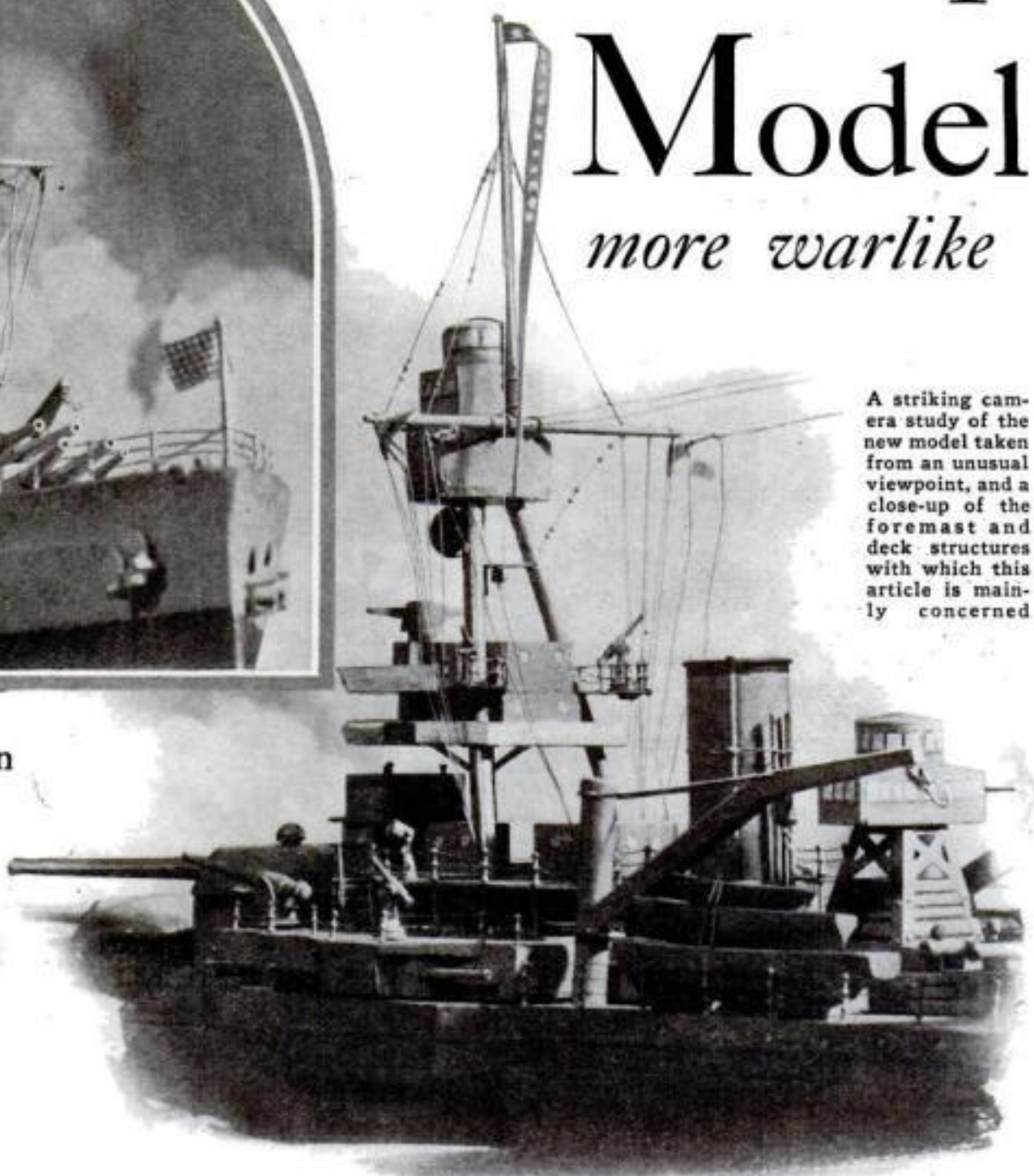
ball,  $\frac{1}{4}$ -in. size with shanks long enough to stick in the deck below to support the edge of the deck as illustrated above.

The guns and other fittings for these decks will be described later.

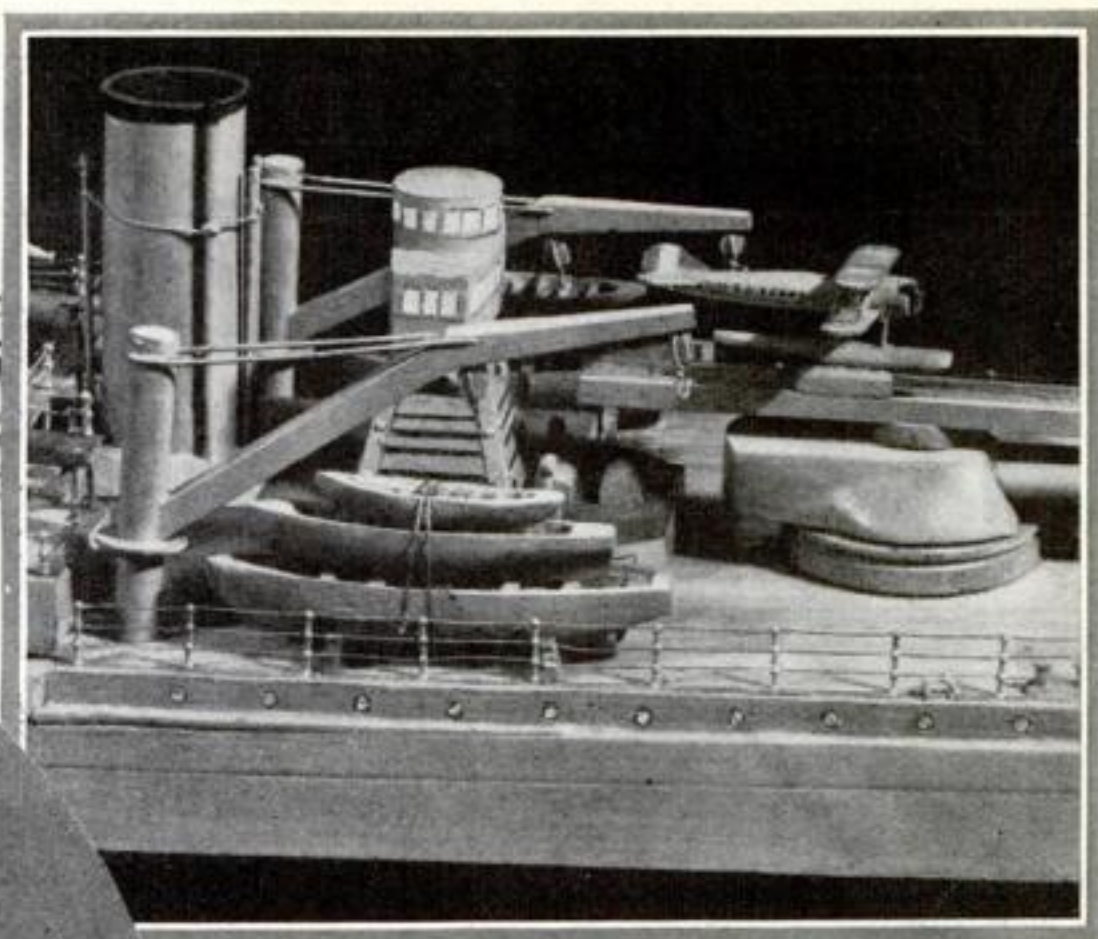
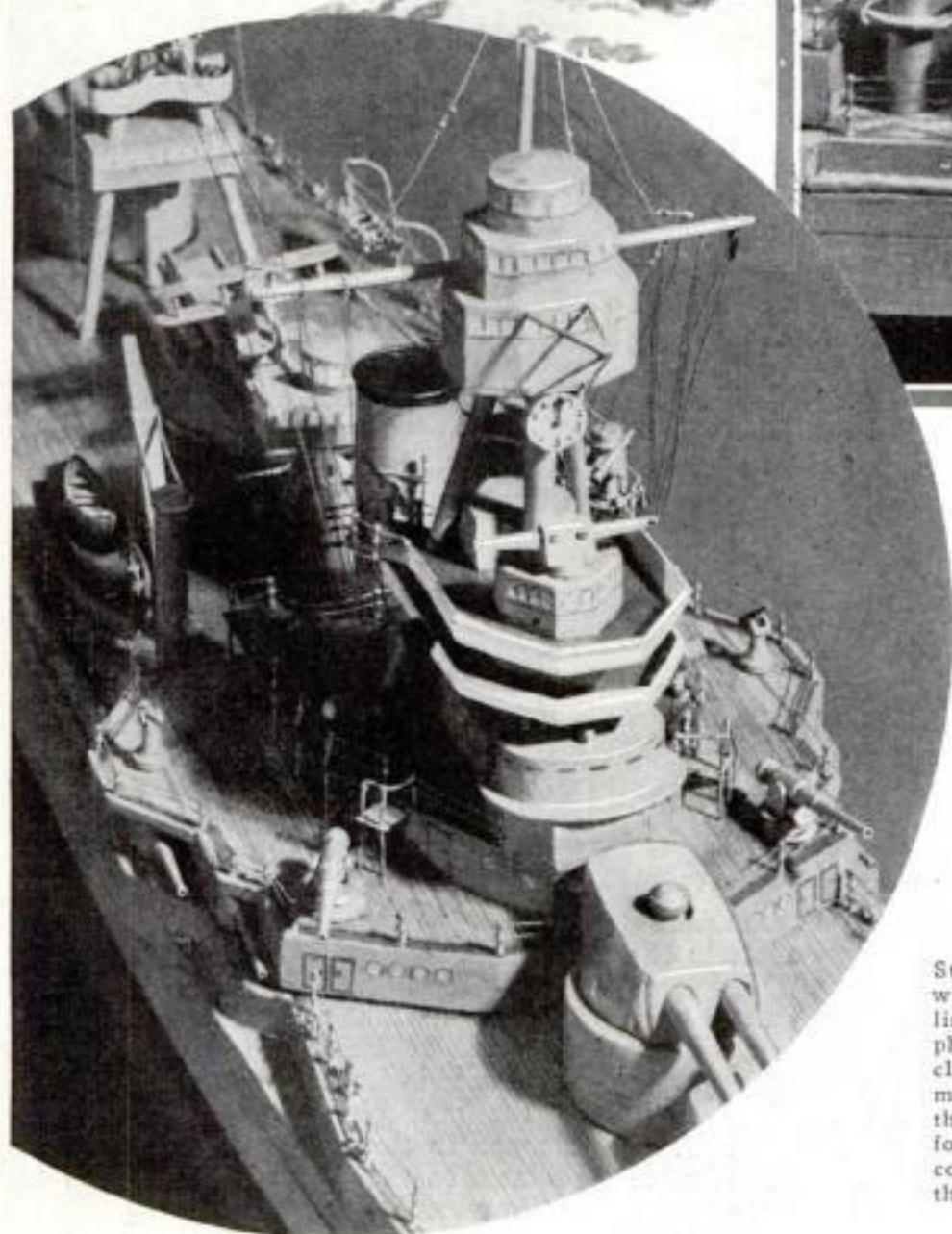
While all this work is under way, the painting of the hull should be carried on. The model should have the usual three or four coats of flat white, rubbed down; then, below the water line, several coats of Indian red (red iron oxide). Everything above the water line should be painted a light blue-gray (battleship gray) except decks 17a, 20, 27, and 29, which are Indian red, the rim around the top of the funnel, which is black, and the weather screens, which are white. The gray is merely white paint with a little black added and a touch of blue to brighten it.

The main deck and deck 17 are left a natural light wood color and varnished, but with no gloss or shine. If desired, a stripe about  $\frac{1}{8}$  in. wide can be stained brown (to represent hard wood) around the edge of the main deck and all erections on it.

A striking camera study of the new model taken from an unusual viewpoint, and a close-up of the foremast and deck structures with which this article is mainly concerned







This instructive side view of the deck fittings between the masts shows the funnel, the strange, slat-like potato locker with auxiliary fire control stations mounted on top of it, the catapult and seaplane, the two large cranes, and nested boats

Studied in conjunction with the drawings published last month, this photograph brings out clearly the various elements built up around the foremast. Note the forked wires above the concentration dial and the yard and its rigging

The actual water line is not shown, but instead there is a black stripe representing the boot-topping,  $\frac{1}{4}$  in. above and  $\frac{1}{8}$  in. below the water line. The simplest way to get an even stripe is to let the red and the gray meet; then, when quite dry, mark the position of the boot-topping and fasten above and below it a strip of gummed paper or tape, painting all between with one or two coats.

**F**ITTED into the after edge of the upper deck is another deck, called in the merchant service the "fiddley." This covers the fireroom (17a). It is  $\frac{3}{8}$  in. thick and has vents painted on the sides, and the deck is red. At the fore end is erected the funnel (41). This can be made from thin metal tubing or by soldering a piece of shim brass around a stick and then withdrawing the stick. In the second case, place a disk about  $\frac{1}{2}$  in. thick in the lower end to preserve the shape of the funnel and to aid in gluing it down. The top can be curled over or have a narrow band soldered on. At the base a square piece of wood should be fitted for the cas-

ing; it is  $\frac{1}{4}$  in. thick with a hole bored for the funnel, and from this hole it slopes down to nothing. If preferred, it can be made from several pieces or shaped from plastic material.

On the foreside is a siren; abaft are two thin exhaust pipes; and on the port side, a  $\frac{3}{32}$ -in. funnel as high as the main funnel. These can all be held in position with a piece of thread or wire around the funnel; pass a turn behind each piece. The funnel should be painted gray outside, black inside, and black around the rim.

The base of the next little tower (auxiliary fire control) is built of a  $1\frac{1}{8}$  in. square piece of wood  $\frac{3}{4}$  in. thick, tapered toward the top. Nailed to the corners of this—it is marked 42 on the drawings—are four angle irons. The cross strips of metal preferably should be on the inside of the angle irons.

Houses 43 and 44 are made of wood to the shapes shown and are glued together. Cuts are made underneath 43 so that it can be pressed onto the angle irons. This part is all gray except the windows, and the base 42, known as the "potato locker,"

has black lines on it to represent ventilating slots as in the photograph above.

Just abaft this there may be four little skylights—just oblong blocks with sloping tops (45), and between them two cowl-ventilators.

In the corner between the upper deck and the fiddley there is a crane (10) on either side. The position of this has been moved out a little to allow the decks to lift off. The upright is a piece of  $\frac{1}{4}$ -in. dowel, set well into the deck. Around this at a point  $\frac{5}{8}$  in. up is a  $\frac{1}{32}$ -in. platform. This should have a tiny motor and levers on it and a handrail around, but these details have been omitted. From the post extends an arm, which I made of two solid pieces of wood. This is supported as shown with a wire, the ends of which are driven into the angle of the arm. Under the angle is a very heavy block, three- or fourfold, for lifting heavy weights. By rights it should be a heavy iron gin-block, but any roundish block will do. At the end is a small twofold block. Each block should have a hook attached. For falls I used thin wire, reeving them through the arm but not so as to show on top. The ends lead down inside.

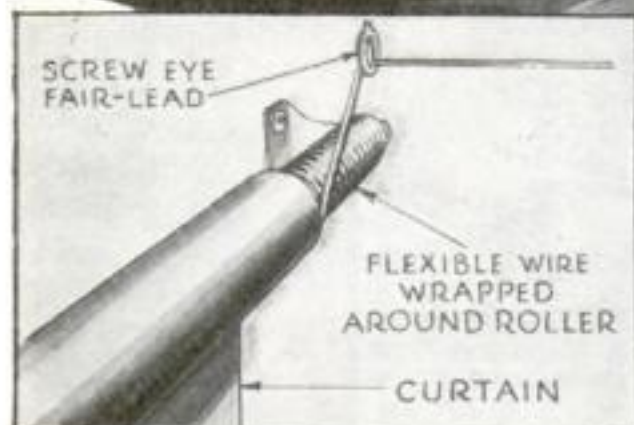
**T**HERE are three boats, nested, on each side of the fiddley—a motorboat, motor sailer, and whaleboat. The shapes of these will be seen in detail 11. I gave them all thwarts and in the lower ones added propellers and blocks to represent the motors. These nested boats are placed on chocks, nailed down, and held with a lashing around all. You may, in addition, correctly have Admiral's barges, punts, and other small craft on the fiddley.

Next month we shall erect the mainmast and complete practically all the deck fittings.

It should be remembered that most of the small fittings required for this model may be bought ready-made, if desired, from model supply houses. When time is an object, this is advisable and, in some cases, less expensive than making them oneself. The larger dealers publish well-illustrated catalogs.

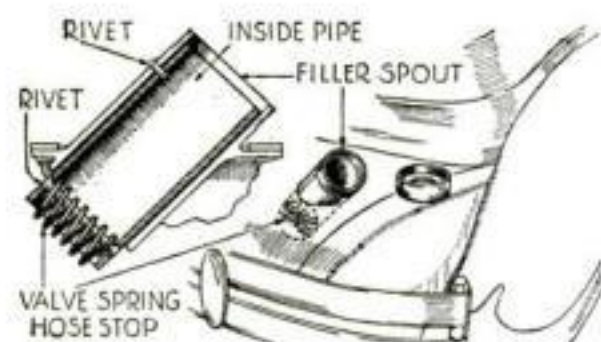


# Valuable Kinks for Your Car



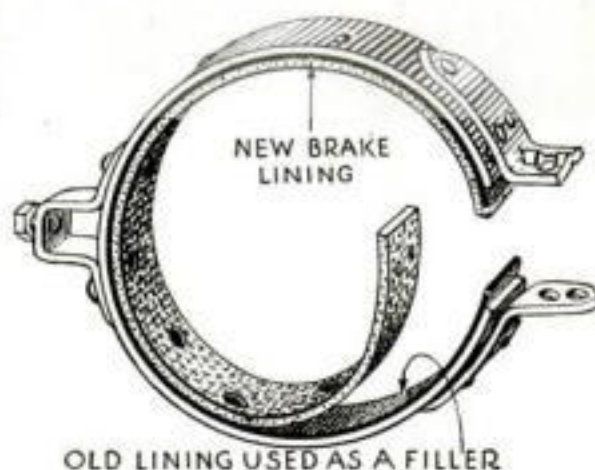
Wire, attached to car's rear window curtain roller, passes through screw eyes to driver's seat and is a means of adjusting the curtain

**B**Y MEANS of the simple rigging shown above, the curtain at the rear window of a sedan can be adjusted to any desired position from the driver's seat. A pliable wire, wound around one end of the curtain roller and guided by means of screw eyes to the driver's seat, forms the handy control. Sufficient wire should be wound on the roller to provide some spare even when the curtain is lowered to its fullest extent. This arrangement is particularly handy when you are driving alone, since the rear curtain can be lowered by simply pulling the wire. To raise the curtain, it is necessary to give the wire a jerk and thus release the spring in the roller. Those who drive at night will appreciate the convenience of being able to adjust the curtain when headlights from behind blind one.—W.I.



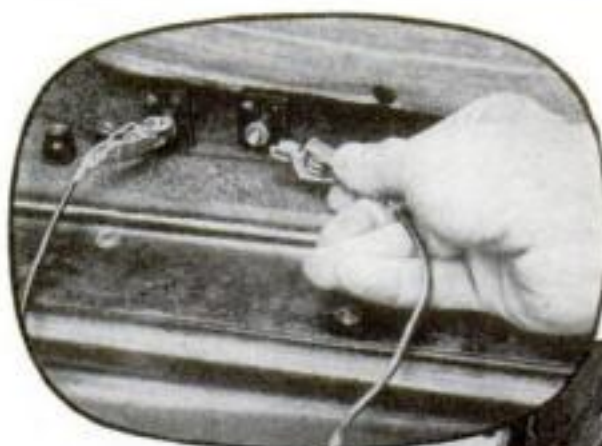
## Guarding Gasoline

**G**ASOLINE stealing, the latest racket of petty thieves, has led many car owners to install locking caps on their gasoline tank filler spouts. A simpler method of protecting your gasoline is shown in the sketch above. A piece of valve spring is fastened inside a short length of pipe which in turn is fastened inside the gasoline tank filler pipe. The spring, held in place with a long rivet fashioned from a nail, will not interfere with the nozzle of the regular pump hose but will not allow a syphon tube or suction hose to be lowered to the surface of the gasoline.—J.W.A.



## Double Brake Lining

**O**N OLD cars, badly worn brake drums sometimes make it impossible to adjust the brakes so they will hold even when the linings are relatively new. This can be remedied by placing the old lining under the new as a filler. When applying a new lining, remove the old, place it under the new, and rivet them both in place with the new one on top. The double thickness makes up for the worn drums and allows you to get the full wear out of new linings. This can be used on internal, as well as external brakes.—S.Z.



Binding posts set in front seat support, as shown at right, simplify problem of charging the battery. Lead wires from charger are clipped to terminals as seen above while charger is on running board

*Old Brake Lining Used as Filler to Take Up Slack in Worn Brake Drums—Handy Light for Night Parking*



## A Parking Light



**F**OR the driver who does a lot of parking at night, the easily-constructed automatic backing light illustrated above and at left is good insurance against scraped and dented fenders. The switch, operated by the gear lever, is an ordinary telephone jack with its casing removed. It is supported on an angle iron placed in front of the reverse position of the gear shift. An extension arm clamped to the shift rod closes the two contacts on the jack when the gears are put in reverse.—E.P.

## Charging Battery

**T**WO binding posts, installed on the front seat support, simplify the problem of charging the car battery in the home garage. The charger is placed on the running board and the lead wires are clipped to the terminals. The binding posts shown in the illustration were taken from an old radio set. The inner leads are clipped to the battery.—K.M.

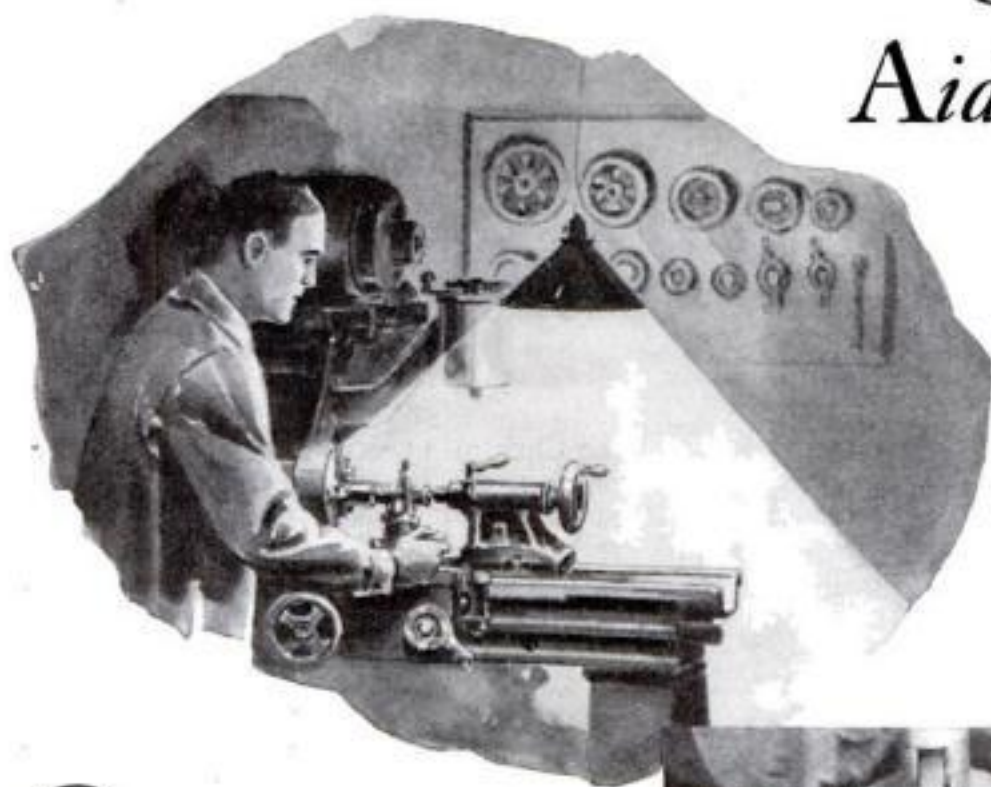




# Homemade Chasing Dial for Lathe

## Aids in Cutting Threads

BY HOLT CONDON



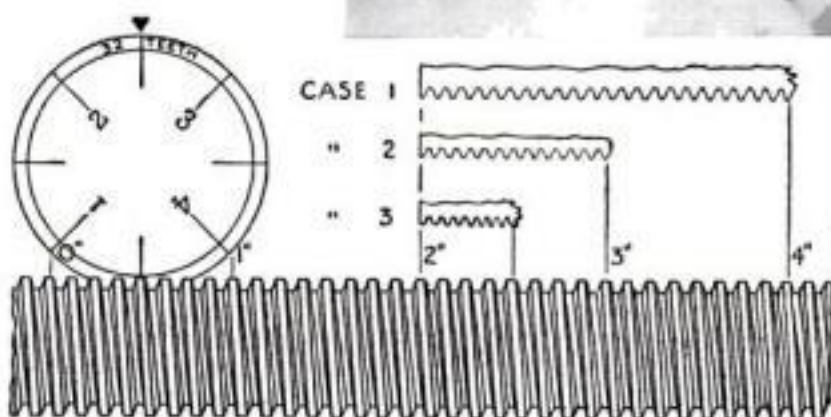
Threads can be cut in the lathe more quickly and with greater certainty if a chasing dial is made and attached on the end of the apron where its worm wheel will engage the lead screw during the entire operation

**C**UTTING threads in the lathe requires a certain knack and the proper equipment if it is to be done rapidly. As skill comes only through practice and as the necessary tools may be made in the home workshop, there is no reason why the amateur should shy at this process. Knowledge of the principles involved is, of course, necessary, but may be had at nominal cost by writing to lathe manufacturers that advertise practical booklets on lathe work.

It is entirely possible to "chase" threads without an indicating dial and cross-slide stop—the two homemade tools to be described in this article. Their function is rather to remove uncertainties and to cut time and labor on this operation.

Cross-slide adjustments, as well as feeds at the compound slide, may be gaged by the graduated collars on the actuating screws. This is a slow method, however, and often leads to trouble through failure to take care of lost motion in the screw—disadvantages which may be overcome by a cross-slide stop. Through its use the cutting tool may be withdrawn and returned to the previous cutting position with certainty. When boring threads, the screw is not passed through the clamp as shown, but contacts on the inside surface, the tool being drawn back to the limit of the stop for each cut.

To bring the cutting tool into the spiral of the thread for each cut after disengaging the split nut from the lead screw, the starting position of the carriage may be located on the ways with a stop and the spindle and lead screw gears chalked to show their angular positions. The stop can be made by running a cap screw into



LATHE LEAD SCREW—8 THREADS PER INCH  
CASE 1 EXAMPLE  $11\frac{1}{2}$  THREADS PER IN. CLOSE AT DIAL 1 AND 3  
" 2 " 13 " " " " " 1,2,3,4  
" 3 " (ANY EVEN NUMBER) " " " ANY LINE

the tapped saddle of the machine where spot-faced for the follower rest, the screw head to bear against the tailstock base. This arrangement, too, is a makeshift and requires much "horsing" of the belt to bring the chalk marks into position. The value of a chasing dial that indicates this spindle-screw-carriage relationship is therefore obvious.

As a preliminary to starting work on this attachment, a full size drawing was made showing in cross section the lathe

shear and lead screw in their proper relation to the carriage apron. This fixed the dimensions and approximate form of the indicator shell, a pattern for which was made and a casting in iron ordered. This casting, chucked bottom end out, was bored through  $\frac{5}{8}$  in. and counterbored to inclose a worm wheel of 32 teeth and  $\frac{1}{2}$ -in. face. A piece of stock was next chucked, turned off to run true, and the casting wrung on for facing and recessing the top or dial end.

The core, which combines dial and shaft, was turned on centers from machine steel. A flange  $1\frac{1}{8}$  in. in diameter and  $\frac{1}{4}$  in. thick forms the dial; and the other end, stepped down for a length of  $\frac{5}{8}$  in., takes the worm wheel, which is bored  $\frac{1}{2}$  in. This small end was threaded with a  $\frac{1}{2}$ -in./20 S.A.E. thread for a standard nut, faced off thin. This nut locks the gear on the shouldered shaft and allows for angular adjustment between gear and dial.

Graduations were planed in the dial by means of a lathe bit mounted on its side, with the work on centers. Indexing was accomplished through a 32-tooth gear placed on the stud—four teeth for each of the eight divisions. Numerals were stamped, and then a light facing cut was taken to clean up. A small hole drilled in the rim of the shell leads oil under the flange of the dial and serves as a fixed



The parts of the homemade chasing dial and, at left, a diagram that explains the principle of its operation

point against which to read the revolving dial during a thread cutting operation.

The writer cut the gear or worm wheel on his lathe by the hobbing process—an interesting problem, but a long story that will have to go over into another issue. When assembled on the shaft, it lies within the shell, the wall of which was cut away at the back to admit the meshing lead screw.

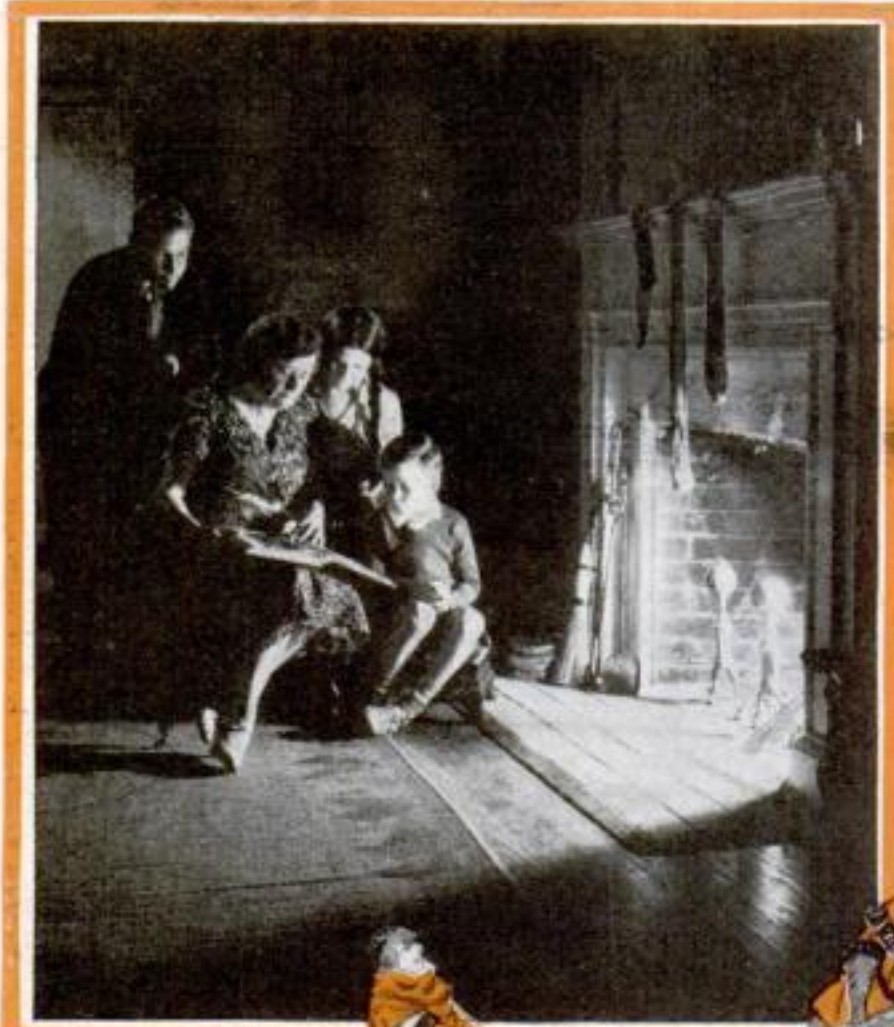
The flat pad on the side of the shell was cleaned up parallel with the bore and a spot filed flat on the end of the lathe apron to take it. (Continued on page 89)



FREDERICK D. RYDER, JR., *tells how to*

# Keep a CAMERA RECORD

## *of your* Christmas



Trick firelight effect obtained with one photo-flash bulb on a drop cord ending in the fireplace



**I**F THERE is one time of the year when every amateur camera should be in use, it is during the Christmas season. There are, in fact, so many chances for good shots over the holidays that some amateur photographers make a practice of putting all the pictures taken

during each Christmas season in a separate small album. The album then forms a pictorial record of the high spots of one year's festivities.

Beginning, for example, a few days before Christmas, the album will start with the details of the holiday preparations. There will be pictures of mother wrapping

the Christmas presents in brightly colored tissue paper and ribbons, perhaps a shot of dad working on the new doll house, and so on. Then comes the night before Christmas with pictures of the children hanging their stockings, mother reading Christmas stories to the children in front of the open fire, and grown-ups at the pleasant job of decorating the tree.

Christmas day will be shown by pictures of the tree with the children examining their presents, views of them exploring the contents of the Christmas stockings, close-ups of one or more of the children playing with the new toys, and at least one of the family and relatives at Christmas dinner.

The rest of the album will cover the children's activities during the week between Christmas and New Year's and will wind up with a picture of the grown-ups assembled for the New Year's Eve party.

Nearly all of these pictures will be taken indoors and most of them at night. The use of the photoflash lamp is advisable because it is so convenient, eliminates the need for time exposures, and insures correct lighting for each picture.

This outline indicates just a few of the possibilities for interesting flashlight pictures during the holiday season. In general, any activity worth watching is also worth photographing. Once you get to thinking in terms of pictures, the chances for good shots appear almost endless.

One point, at least, is in your favor when you take pictures around Christmas time.

## \$100 in CASH AWARDS for Christmas Photos

NO MATTER how little experience you may have had in photography, your chances are just as good as those of any other reader to carry off one of the six cash prizes, amounting to \$100 in all, which we are offering for the best indoor Christmas photographs. The awards will be made for those pictures that are most successful in conveying the spirit of Christmas—pictures of the kind you would take for an album such as Mr. Ryder describes in the accompanying article.

Take a number of views, pick out the best, and send a print of it, together with the negative, to the Photographic Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York, not later than February 1, 1933. Mark your entry "Christmas Photo Contest."

The list of six prizes is as follows:

FIRST AWARD.....	\$50
SECOND AWARD.....	25
THIRD AWARD.....	10
FOURTH, FIFTH, and SIXTH AWARDS, \$5 each.....	15
TOTAL.....	\$100

The reason why even a beginner has an excellent chance in this contest is because the introduction of photoflash bulbs has overcome practically all the old difficulties of taking indoor photographs. There is no longer any need for uncertainty; if you follow instructions, the results will be good. The contest is intended primarily to encourage you to learn this modern method of making flashlights, although daylight

or any kind of illumination or flashlight may be used. The developing and printing may be done by a professional, but the picture itself must be taken by an amateur. The only other requirement is that it be taken within the two months of December, 1932, and January, 1933.

Write on the back of the print what illumination was used—daylight, artificial, or flashlight, and if flashlight, which type. You may enter several pictures if you wish, but no entries will be returned. The contest is open to all except employees of POPULAR SCIENCE MONTHLY and their families. In case of ties, each tying contestant will be awarded the prize tied for. The pictures will be judged on their photographic qualities and the appropriateness and human interest of the subject.



# Tom finds out how to picture CHRISTMAS JOYS AND THRILLS

DON, YOU SURE KNOW HOW TO TAKE INDOOR PICTURES! AND YOU SAY THAT G. E. MAZDA PHOTOFLASH LAMPS MAKE THEM AS EASY TO TAKE AS SNAPSHOTS IN THE SUN? BOY THAT'S WHAT I WANT FOR SOME REAL CHRISTMAS PICTURES.



DARLING, THESE NEW LAMPS ARE GOING TO GET US THE CHRISTMAS PICTURES WE'VE ALWAYS WANTED - PICTURES THAT REALLY SHOW THAT THRILL OF WONDER AND JOY WHEN THE CHILDREN CATCH THEIR FIRST SIGHT OF THE TREE ON CHRISTMAS MORNING.



G. E. MAZDA Photoflash lamp for action shots, babies, parties, pets

NOW - WE'RE READY FOR PICTURE-TAKING... SEE HOW EASY IT IS?



TOM, THESE PICTURES ARE SIMPLY MARVELOUS! I NEVER DREAMED OUR CAMERA COULD GET SNAPSHOTS LIKE THESE IN THE HOUSE. WE MUST KEEP G. E. MAZDA PHOTOFLASH LAMPS ON HAND ALL THE TIME NOW.



AND THIS IS ONE OF THE PICTURES TOM GOT



G. E. MAZDA Photoflood lamp for time exposures, portraits, interiors

All of these illustrations as well as this indoor snapshot of Tom's were taken with G. E. MAZDA Photoflash lamps.

## TAKE PRIZE PICTURES IN YOUR HOME!

YOU CAN TAKE PICTURES as natural and striking as these with your camera this Christmas . . . if you use G. E. MAZDA Photoflash lamps. Flash! and the scene is yours before subjects wink an eye. Catch the spontaneous joy of Christmas. No noise, smoke, smell or muss. Each picture calls for a new lamp.

And for time exposures . . . portraits . . . interiors and other "still" pictures, use G. E. MAZDA Photoflood lamps. They enable ordinary box or folding type cameras to get beautiful, clean-cut pictures with exposures of 1 to 5 seconds.

They are good for 2 hours of picture-taking. And they are the best lamps ever developed for taking home movies!

Ask your druggist or photo-supply dealer about G. E. MAZDA Photoflash lamps and G. E. MAZDA Photoflood lamps. Better still, get some lamps and take your own prize pictures. General Electric Company, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC  
MAZDA PHOTOFLASH LAMPS

GENERAL ELECTRIC CO., Nela Park, Cleveland, Ohio  
**FREE:** Please send me, free, a copy of "How to make GOOD pictures INDOORS".

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

P. S. M. 1-1933



The joys of the season are reflected in the expressions of children and grown-ups alike, and your subjects do not have to be urged to look pleasant. But even the happiest child will become fretful if you insist on formal poses and keep him waiting too long.

The advice often is given to take your pictures without the subject's knowledge so as to get natural and easy expressions. That's good advice, but you can't always follow it. The wrapping of the Christmas packages, for instance, may be going on at a table in such a position that the only possible picture you can take unawares is a back view.

The solution is a compromise. Tell the grown-ups or children that a picture is to be taken and get them in the proper position. Then suggest that they go ahead with whatever they are doing while you get the camera ready.

Fiddle around with the camera adjustments, look into the finder several times, hold the photoflash lamp in various ways as though studying the proper lighting effect. Keep this up till your subjects lose interest in your preparations. Then watch for the pose and facial expressions you want and when you see them, snap open the shutter and touch off the photoflash.

I have tried this trick several times with excellent results. Often, if the room is brightly lighted, your subjects will not notice the flash at all. Even if they do, no harm is done, because the quick, silent flicker of light is all over and the picture safely recorded on the film before the involuntary twitch of an eyelid can take place.

There are other trick ways to get easy, natural expressions in your photoflash pictures. One is to put the photoflash bulb in a properly placed floor lamp or wall bracket before you assemble the group. After you have them arranged as you want them, ask everybody to hold still for a short-time exposure. Of course, they will all freeze into the characteristic posed expressions.

**A**CTUALLY go through the motions of taking a time exposure. An easy way to accomplish this is to leave the shutter set on "bulb." Then when you start the fake exposure, press the release just as you would for a time exposure. Of course the shutter simply opens and closes at once as you release the pressure on the button, and the film is not affected by the fraction of a second exposure if there is only artificial light in the room. At the end of five or ten seconds, you press the button again and hold the shutter open, at the same time announcing loudly that it's all over.

At your announcement every face in the group will relax, usually into a natural smile and that will be the signal to



Avoid having the tree in the exact center of the picture, and keep the children playing with toys so they will not stare at the camera

touch off the previously prepared photoflash bulb.

There are many possible variations on this faked time-exposure idea. You will have to arrange the details to suit the circumstances and the subject. Don't try it with daylight in the room unless you do it in such a way that the shutter will not be open at all until just before the flash. Otherwise a well-lighted face or two will register twice and give a double exposure.

The photograph of the Christmas tree is one of the most important in your holiday album and also one of the most difficult to take. The dark green needles

taken in by the camera, and do not have the room too brightly lighted.

Use verichrome type film to prevent the bright points of light from spreading into hazy blurs and open the shutter four or five seconds before you shoot the flash. The fact that the children move during this period is unimportant.

**I**N MANY cases it is not possible to place the camera so as to include the whole tree. Don't let that worry you. A pleasing arrangement of one or more of the children with part of the tree as a background is just as interesting.

The worst possible Christmas tree picture is one showing the dark mass of the tree looming up in the exact center of the picture space with neither its base nor its top within the limits of the view.

Another holiday season picture that usually taxes the amateur flashlight photographer's ingenuity is the view of the family and relatives assembled around the Christmas dinner table. With the table fully extended, it is, more often than not, quite impossible to place the camera where everybody will be in the picture. Of course, if there are double doors leading into another room, you can set up the camera in the adjoining room and place two photoflash bulbs, one at each side of the door, where the partition will keep light from reaching the camera lens. Be sure to place the camera so high that those nearest will not block off those on the far side of the table.

When there are no double doors, the only solution is to take the group in sections, shooting across the table.

## Our BLUEPRINTS Insure Success

**B**EFORE you begin to build any project whatever in your home workshop—whether it is something described in this issue or not—look up the list on page 78 to see if blueprints are available. If they are, take advantage of them.

Our blueprints cover many subjects, and they are all large, clear drawings so carefully detailed that it is a pleasure to use them. They will do more than any other one thing to insure your success.





ON CHRISTMAS COUNTERS

# New principle Ciné-Kodak



• CINÉ-KODAK EIGHT is small, simple, complete. A real full-fledged movie camera. Price only \$29.50 . . . and it cuts film cost exactly 62½%.

using a  
**NEW FILM**  
that cuts movie cost  
nearly  $\frac{2}{3}$

• Remarkable new discoveries revolutionize home movie costs . . . Offering home movies at a price anyone can afford . . .

A new Eastman movie camera—Ciné-Kodak EIGHT. Entirely new in principle. Different in the film it uses.

Ciné-Kodak EIGHT takes splendid movies . . . yet it costs you only \$29.50.

Uses a completely new, marvelously fine-grained film. One foot of it does the work of four. A 25-foot roll at \$2.25 runs as long on the screen as the usual 100-foot roll at \$6. Saving 62½% in cost.

Kodascope EIGHT . . . only \$22.50 . . . projects the film . . . strong, steady, flickerless.

Go to your nearest Ciné-Kodak dealer. He'll gladly show you this "EIGHT" outfit and the remarkable movies it makes at such remarkably low cost. A marvelous Christmas gift—appropriate, exciting, permanent. Eastman Kodak Company, Rochester, New York.

## • THE NEW PRINCIPLE

Ciné-Kodak Eight makes a special 25-foot film, 16 mm. wide, do the work of 100 feet. It runs the film past the lens twice, leaving two separate rows of images along its full length. Eastman finishes this 25-foot 16 mm. film, slits it, splices it, and returns it to you as a single 50-foot 8 mm. film, ready to project in Kodascope Eight. The cost of finishing is included in the price of the film.

# Ciné-Kodak EIGHT

*Eastman's*

NEW-PRINCIPLE *Movie Camera*





Whew!  
Who's cooking  
cauliflower?



**W**HEN you smoke a foul, reeking pipe, you may think you're getting away with it with your hostess. But you can't fool a bird.

For your own sake as well as others, start today smoking a *good* tobacco in a well-groomed pipe. Sir Walter Raleigh's mild mixture of Kentucky Burleys is an excellent tobacco. It's so mild that it always pleases the most haughty hostess. And it's so rich, fragrant and full-bodied that it will give you infinite satisfaction. Your tobacco store has it—kept fresh in gold foil.

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It's 15¢—AND IT'S Milder

## Building a MODEL RAILWAY Signal Bridge and other hints



A simple but realistic signal bridge constructed from strip brass and square shaped radio bus wire

**W**ITH a supply of strip brass,  $\frac{1}{4}$  by  $\frac{1}{32}$  in., and square shaped radio bus wire, you can build a fine looking signal bridge for your model railway. The work goes much easier with an electric soldering iron, but a stove-heated copper will serve satisfactorily.

First solder the main frame, using the strip brass, and then add the cross braces of bus wire. At one end you can place a ladder of bus wire and at the other end solder a piece of small diameter brass tubing to act as a conduit for the light wires. The signal bridge illustrated above is the right size for a two-track "O" gage line.

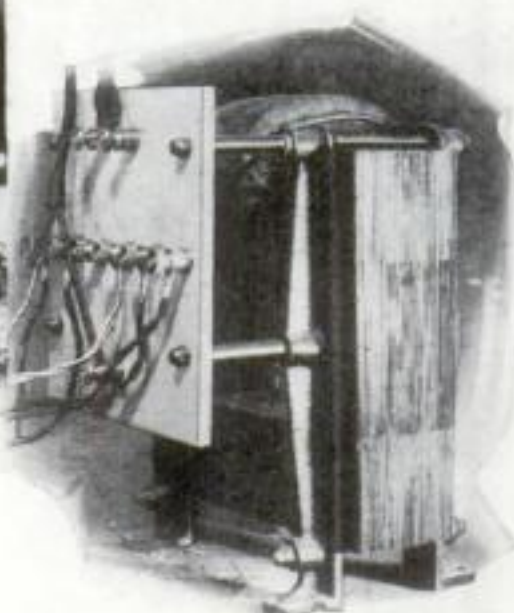
### Low-Cost Transformers for Large Railways

**H**IDDEN away in junk yards and under the shelves of secondhand electrical supply dealers there are many old, burned-out  $\frac{1}{2}$ - or 1-kilowatt power transformers. Rewound, one of the transformers will supply all the power needed for the largest model railway installation.

A 1-kilowatt, 15,000-volt transformer is illustrated. The original winding was removed by taking the core to pieces. Then it was rewound with 200 turns of No. 14 magnet wire for the primary and 32 turns of No. 8 magnet wire for

the secondary. When no current is being drawn from it, it takes only 17 watts of current from the electric line. It will run four large double-motor locomotives, about thirty miniature electric light bulbs, and seven 12-volt, 32-candlepower auto headlight bulbs for hours at a time without overheating.

Transformer cores are made of interleaved sheets of metal. If the construction is such that the winding holds the core together, you can remove the old winding by cutting straight through it with a hack saw.



Junked transformer from an old spark transmitter rewound for model railway purposes

### Installing a Turntable for Locomotives

**I**LLUSTRATED below is a home-constructed locomotive turntable that follows real railway practice. If your track layout is on a wooden bench, cut a circular hole through it at point where you wish the turntable to be. Fit the rim of the hole with a curved piece of thin board or heavy cardboard and make a bottom from the piece you cut out of the hole. At the exact center of the bottom, drive a heavy nail up through it. This acts as a pivot. Lay a single rail around the edge of the

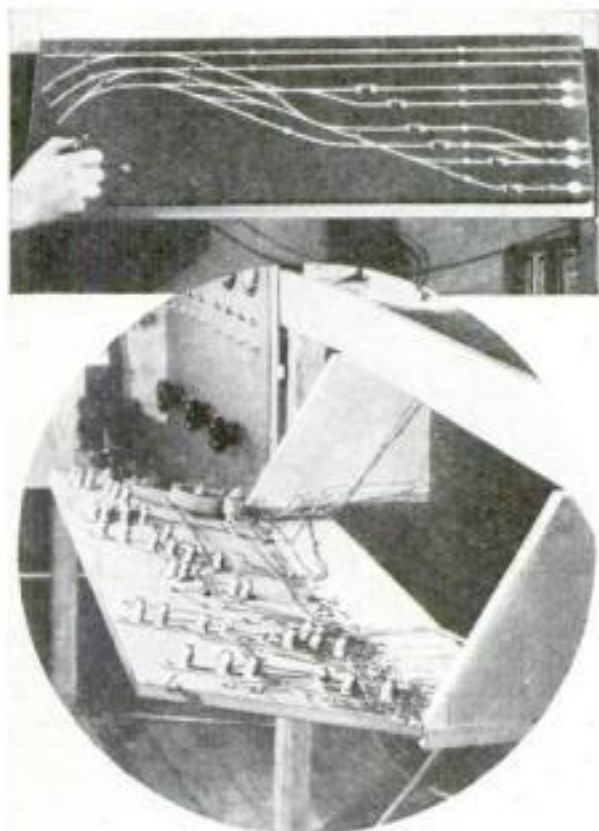


This turntable is set on a central pivot and rests at each end on wheels that run on a circular track



bottom of the hole. The rotating table, which carries the track, should be strongly constructed of wood and fitted with a pair of wheels at each end. These wheels carry the load.

This method of building a turntable also can be used with the regular standard and "O" gage sheet steel track. Instead of laying a rail around the edge of the bottom of the hole, a thin strip of wood can be bent into place. The four wheels may be taken from a discarded car.



Illuminated indicator board closed as in use, and open to show the concealed wiring

### Terminal Layout Shown on Indicator Board

A MINATURE diagram of a model railway terminal with white lines painted on a black panel is shown above. Set on these lines at the proper points are tiny jeweled lights, switches, and push buttons. The push buttons are used to supply current to the sidings. This is good practice because it makes it impossible to forget to cut off the current to a siding. The snap switches are used to throw on the jeweled indicator lights to indicate which track the train will take in coming into the yard.

Of course, such complicated terminal construction is not possible with sheet steel track, but the terminal board can be used for a simpler layout if desired. The knob shown at the left end of the board controls the current to the locomotives while they are in the yard and is connected to the rheostat at the far end of the board as shown in the open position in the second photograph.

### Holding Small Nuts

It is often difficult to hold small nuts in inaccessible places. An effective method is to solder a wire or a strip of brass very lightly across the hole in the nut and then bend this handle so the nut can be placed wherever necessary. When the bolt is screwed through the nut, it will break the solder.—C. M. B.

# This Coupon Brings You the New FREE WORKACE Catalog

J. D. WALLACE & CO.  
Wilcox and California Ave.  
Chicago, Ill.

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- ☐ Please send complete catalog No. 409.  
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Catalog No. 409



#### WORKACE Circular Saw

Will cut at any angle, either cross cutting or ripping, or compound angle. Maximum ripping width, 6". Maximum cross cutting width, 5". Maximum depth of cut, 2". Table tilts to 45°, raises and lowers. Removable throat opening for dado heads, cope heads, etc.

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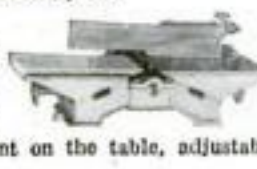


#### WORKACE 4' Planer

Will joint stock 4" wide and rabbet 1/4" deep. Circular safety type cutterhead. Table accurately ground. Rear table provided with rabbetting ledge. Fence adjustable to any point on the table, adjustable to 45°.

**\$10**

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#### WORKACE Jig Saw

Table tilts either way 45°. Universal blade holder permits use of various types of blades. Maximum depth cut 1 1/2". Capacity using gooseneck 12". Goose-neck removable giving unlimited capacity using saber blades, files, etc.

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#### WORKACE 36" Lathe

Capacity over tool rest 6" diameter. Capacity over lathe bed 8 1/2" diameter. Capacity between centers 20". Non-splitting live center. Equipped with 6" and 12" tool rests, two 2-step pulleys and 30° V-belt.

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#### WORKACE Home Woodworker

Five feet long—and every inch a real tool. Performs 25 different woodworking operations. Consists of 4" Planer, an 8" circular Saw, an 6"x36" Lathe, an 8" Sanding Disc, a 6" Buffer, a 5" Emery Grinder, a 1/2" Drill Chuck, Auxiliary Tilting Work Table and Jig Saw attachment. Arranged for Floating Drive. Enough power, strength and capacity to do any job in the home shop.

**\$70**

without motor f o b Chicago



#### WORKACE Shop Woodworker

A fine outfit for the small shop or the man who wants to go into business. Includes everything described in the Home Woodworker, but is equipped with cast iron stand, hardwood work table and tool drawer. The new improvements of Floating Drive for 1/2 horse-power motor are also incorporated in this model.

**\$97**

without motor f o b Chicago



#### WORKACE 14" Bandsaw

Capacity between gooseneck and blade is 14", unlimited capacity to the right of the blade. Will cut stock 6" thick.

**\$60**

without motor f o b Chicago

#### WORKACE Planer Saw

Consists of 4" Planer and 8" Circular Saw mounted on a cast iron base.

**\$62**

without motor f o b Chicago



**J. D. WALLACE & CO.**  
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**BAND SAW**  
For Greater Variety  
of work

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**WORLD'S LARGEST  
BUILDERS OF  
PORTABLE WOOD-  
WORKING MACHINERY**



# Goodbye SANDPAPER CHIN



## Here comes the new **DURHAM** DUPLIX SAFETY RAZOR

EVERYBODY wants an ALL DAY shave—and here it is! Try this NEW razor—and get rid of that "sandpappy" feeling that comes a few hours after shaving. It's all in the long blade—the shaving angle—and the design! Simple and sure. Nothing to learn—just shave! Note these important features:



- 1: EXTRA LONG double-edge blade
- 2: PERFECT BALANCE
- 3: CORRECT SHAVING ANGLE
- 4: NO VIBRATION
- 5: NEW "HANDY GRIP" HANDLE
- 6: EASY TO CLEAN

**DURHAM-DUPLEX RAZOR CO.**  
Jersey City, New Jersey  
Copr. Durham-Duplex Razor Co., 1933

## HOME WORKSHOP BLUEPRINTS

New projects are marked with an asterisk (\*)

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. The blueprints are 15 by 22 in. and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means

that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by a special reprint of the instructions originally published in the magazine. If you do not wish this reprint, omit the letter "R" from your order and deduct 25 cents from the price given. Reprints alone are sold for 25 cents each.

### Flying Airplane Models

Bremen (Junkers, 3-ft. Flying), 89-90.....	\$ .50
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Tractor (Record Flight 6,024 Ft.), 104.....	.25
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(See page 84 for kit of materials)	
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(See page 84 for kit of materials)	
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Yacht, 20-in. Racing, 48-R.....	.50

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### Miscellaneous

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### Popular Science Monthly 381 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

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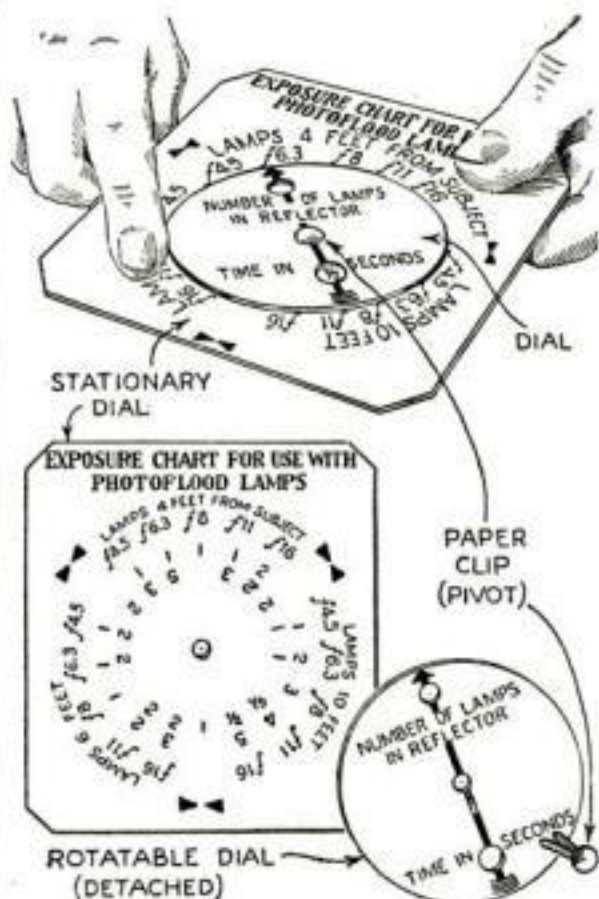
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Note: Please print your name and address very clearly. If you do not wish to cut this page, order on a separate sheet.



## SIMPLE EXPOSURE CHART AIDS IN TAKING GOOD FLOOD-LIGHT PHOTOS



How the chart appears in use, and the parts separated to make the construction clearer

AN EXPOSURE chart to guide you in your use of the new flood-lighting lamps for indoor photography can be prepared easily from good quality white cardboard, Bristol board, or celluloid.

Cut a piece 3 in. square and, by drawing diagonals, find the center. Punch a  $\frac{1}{8}$ -in. hole at this point. It is also desirable to cut the corners from the square so it will not catch in the pocket. Next cut a 2-in. diameter disk out of the same material and punch a  $\frac{1}{8}$ -in. hole through the center. Draw an arrow through this center as shown. On this arrow,  $\frac{1}{4}$  in. from the pointed end, punch or cut a  $\frac{1}{4}$ -in. hole, and another  $\frac{1}{4}$ -in. hole  $\frac{1}{2}$  in. from the tail end of the arrow. Letter beside the first  $\frac{1}{4}$ -in. hole, "Number of lamps in reflectors," and alongside the second, "Time in seconds."

Fasten the square and the disk together

### TIME EXPOSURE TABLE

For film of verichrome and plenachrome type

Distance— lamps to subject	Diaphragm opening	Number of lamps in reflectors	Time in seconds
4 ft.	F 4.5	1	1/5
"	F 6.3	1	1/2
"	F 8	1	1
"	F 11	1	2
"	F 16	1	4
6 ft.	F 4.5	1	1
"	F 6.3	1	1
"	F 8	1	2
"	F 11	2	2
"	F 16	2	4
10 ft.	F 4.5	1	2
"	F 6.3	2	2
"	F 8	3	2
"	F 11	4	3
"	F 16	5	5

NOTE: For inexpensive cameras use largest stop opening and exposure data given above for F 16. For ordinary roll film use twice exposures given above.

# New Circular Saw Astonishes Woodworkers

## New 1933 "Delta" Model



## Scores of New Features

### Radically New Design

DESIGNED completely new from the ground up, this latest 1933 "Delta" Saw has every feature that woodworkers have wanted for years—and yet it is so moderately priced as to be within the reach of all. It offers extra space in front of the saw blade, where it is most needed, plus all the advantages of a table 4 feet square, at a fraction of the ordinary cost of a large table. It incorporates scores of important improvements and exclusive features. With a choice of designs available, "Delta" engineers, after thorough tests on all types of work, and under all conditions, selected the TILTING TABLE design (no tilting arbor) as being the most efficient and practical. For full details, see the new 1933 "Delta" Catalog.

## 10-DAY TRIAL

**Easy Terms** Because "Delta" Woodworking Tools are efficient and practical under actual working conditions, they are always available for a 10-Day Trial without the slightest risk. Satisfaction is guaranteed. For full details of this liberal offer and also of "Delta" Easy Payment Plans, fill in and mail the convenient coupon below, TODAY!

DELTA MFG. CO., 3775 North Holton Street  
Dept. B133, Milwaukee, Wis.

Delta Mfg. Co., 3775 N. Holton St.  
Dept. B133, Milwaukee, Wis.

Please place me, without obligation, on mailing list to receive the FREE 1933 "Delta" Catalog of Quality Woodworking Tools. Also send full details of your 10-Day Trial Offer and Easy Payment Plans.

Name.....Age.....

Address.....

City.....State.....

## A Complete Line of "Delta" Motor-Driven Tools

"Delta" Woodworking Units are convenient, portable and compact. All are available in a large variety of combinations and at prices to fit all needs. The "Delta" line includes Jointers, Circular Saws, Band Saws, Woodturning Lathes, Drill Presses, Scroll Saws, Boring, Routing, Sanding, and Mortising Attachments—and a complete line of accessories.

## Catalog FREE

Shows the complete line of latest "Delta" Tools. It is packed full of interesting illustrations and descriptions. It describes the latest developments in motor-driven equipment at the astonishingly low 1933 price levels. For FREE copy fill out the coupon at the right and mail it TODAY!



## GEARS

In Stock—Immediate Delivery

Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on special gears of any kind. Send us your blue prints and inquiries.

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CHICAGO GEAR WORKS

769-773 W. Jackson Blvd., CHICAGO, ILL.

## SHIP MODEL FITTINGS

BUILD THE U. S. S. TEXAS

We can supply all those hard to make deck fittings—stanchions, 1-16" and 3-32" airports, guns, davits, capstans, bells, ladders, modern anchors, propellers and shafting. Construction kit for this model if desired.

We also have complete line of hulls and fittings for Sailing Ships, Destroyers, Yachts, etc. Send for illustrated catalog.

A. J. FISHER

1002-2 Etowah Ave. Royal Oak, Mich.



# 4 PM to 6 PM



## are my BUSINESS HOURS

After school from 4 to 6 P.M. I run my business. I make jig saw puzzles, animal cut-outs, lawn ornaments, and block letters with prices for the display windows of stores. I'm always busy, too. There are plenty of odd jobs showing up when you have a workshop. I sell to our neighbors, and to one of the local novelty shops. The money I make keeps me in school clothes and spending money. It's easy. Why not try it yourself?



**JIG SAW \$6.50**

This Driver tool is a workshop in itself. Handles dozens of jobs. Comes with fret saw adapters, 1 1/4" pulley, 42" endless belt and pkg. of 9 assorted blades.

**DRILL PRESS \$12.75**

Drilling, inlaying, shaping, mortising, tenoning and dovetailing are efficiently performed on this high speed drill press. Head may be inverted for shaping. Priced without motor.

**7" BENCH SAW \$11.00**

This Driver 7" circular saw cuts wood up to 2 1/4" thick. Rips and cross-cuts straight or at any angle up to 45°.

Insert in table is easily removed for grooving, disc sanding or surface grinding.

**DRIVER POWER TOOLS**  
WALKER-TURNER CO., INC.  
PLAINFIELD, N. J.

Write for catalog

at the center with a paper fastener. Mark around the outside of the disk the first column of figures given in the accompanying table, placing them as in the illustration. Through the two holes in the disk, letter the figures recommended in the table for use with the given aperture. For instance: (a) Point the arrow to F/4.5 (lamps 4 ft. from subject). (b) Fill in for number of lamps—1. (c) Fill in for time in seconds—1/5. Repeat this for all of the apertures for the given distances.

After the table has been put on the chart, the user can make changes mentally to suit his needs. For instance, where one lamp at F/8 requires one second (as in the table), only one-half second would be required if two lamps were used.

These figures are for rooms with fairly light walls and ceilings. In large, dark rooms, slightly longer exposures are needed for good results.

## OLD PISTON SERVES AS SMALL GAS FURNACE

A SMALL gas furnace suitable for melting lead, babbitt, aluminum, and other soft metals and for heating steel for bending, annealing, and tempering, can be made from an old auto piston, a flat piece of iron, and three or four bolts to serve as supports or legs.

For the iron base, I used a plate of the kind placed between



Steel quickly becomes red-hot in this furnace

the rails and ties of a railroad track. It already had three holes through which bolts could be passed, and it was corrugated on one side so that the piston could be set horizontally as shown and lined up with the gas pipe. The open end of the valve at the end of the gas pipe is closed with a plug in which a hole about 1/32 in. in diameter is drilled. The gas is mixed with air on passing from this nozzle to the piston and produces an intensely hot, roaring blue flame. It is necessary, of course, to slide the furnace back and forth until the correct distance from the nozzle has been found—usually from 5 to 8 in.

Either end of the piston may be turned toward the nozzle, depending upon the type of work to be done; or it can be set upright on its closed end so that the gas enters one of the wrist pin holes, and a ladle for melting lead can be set in the open end.—ERNEST M. WILKEY.

Big 12" Hula Glider  
Free with each kit

Amazing Dipper  
comes off ground. Also  
like bird. Flew 500 ft.  
for Latent Coils. 1 Weighs 1/2 oz. Easily built!  
Only 50c prepaid for COMPLETE KIT with  
Free Glider. In big  
box! Or  
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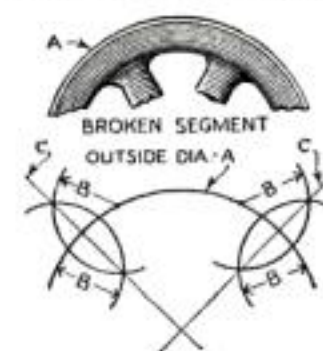
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## INTERESTING EXPERIMENTS WITH SOLUTIONS

(Continued from page 49)

solution at the bottom of the test tube or beaker. This strong solution then gradually mixes with the water above it until the entire solution is of uniform strength. In the case of blue copper sulphate, this gradual mixing is plainly visible because of the color.

Not all substances dissolve in the same proportions in the same quantity of water. Given two different substances, it may be possible to dissolve two teaspoonfuls of one in a glass of water while only one teaspoonful of the other will dissolve in the same quantity of water. The first solution, of course, will be denser and heavier than the second.

These two properties—diffusion and difference in density—form the basis of an interesting and mystifying experiment that to the casual observer will seem a difficult feat. It consists of carefully placing liquids of different colors, one on top the other, without any visible mixing of the layers.

THE experiment, which has been named "Jacob's tube," is performed in a long test tube. In order to place the various layers carefully, the amateur chemist should improvise a long dropper by fitting a length of glass tube with the rubber bulb of a fountain pen filler or medicine dropper.

First place a drop of mercury in the bottom of the test tube. If mercury is not on hand, a strong salt solution can be used instead or both can be used if desired. A strong copper sulphate solution is then carefully floated on top of the mercury or salt solution.

On top of the copper sulphate, float a solution of iron sulphate and on top of this a purple solution of potassium permanganate. Next, bands of clear lead acetate and yellow potassium chromate solutions and a layer of clear water can be floated one on top of the other above the potassium permanganate.

To add to the effect, layers of castor oil and light machine oil can be added on top of the water. These do not have to be placed carefully but can be poured directly from their bottles. Red gasoline can be added next.

If a small amount of colored alcohol, either rubbing or otherwise denatured, is then poured in on top of the gasoline it will not float, but will flow down the sides of the test tube without mixing and come to rest between the machine oil and the gasoline.

THE result is a tube of various colors arranged in distinct layers. Of course, the chemical solutions at the bottom of the tube in time will diffuse into the adjacent layers, but the upper bands, composed of liquids of different densities, will not mix.

According to the stock of chemicals he has on hand, the home chemist can vary his Jacob's tube to meet the supplies in his laboratory. Ordinary household materials such as olive oil can be added if desired.

## USE CHICKEN FEATHERS TO MAKE PLANE QUIET

AIRPLANES with feathers may soon be adopted on the large airlines. However, the feathers will not be used for support but for deadening the sound of the engines. Experiments being carried on in a Baltimore, Md., laboratory have shown that a layer of feathers between the walls of a plane's cabin does much to make the interior soundproof. The quills, it is said, absorb the sound transmitted from the tiny vanes. One of the largest American aviation companies recently completed successful tests, using ordinary chicken feathers as the soundproofing material in the cabin walls.



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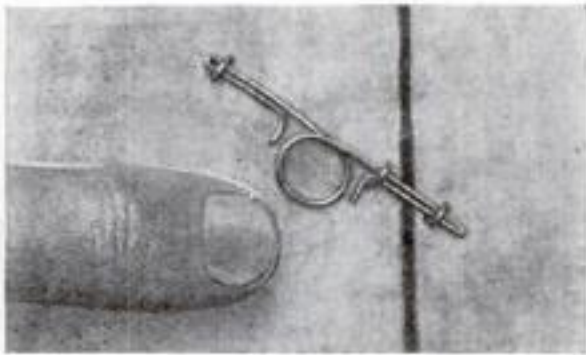
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## SMALL DOOR LATCHES BENT FROM WIRE



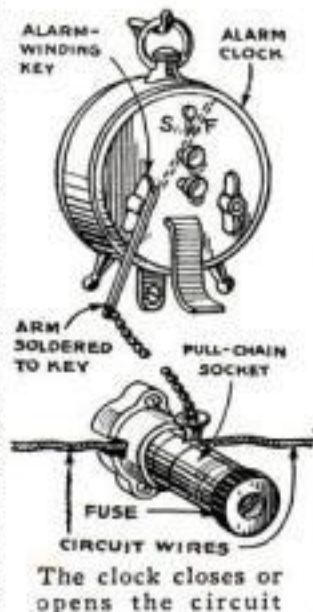
Neat combination door latch and pull made from a short bit of wire and three staples

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CONSTRUCTION Kits of materials for building a 3 ft. long exhibition model of the U. S. S. *Texas*, flagship of Battleship Division I and one of the most powerful battleships, have been assembled under the supervision of the Popular Science Homecraft Guild. Each kit contains the necessary wood, sheet brass, wire, rods, brass tubing, chains, beads, nails, escutcheon pins, and other materials—in fact, everything but the paints. (If it is desired to install a power plant in the model, the machinery, of course, will have to be obtained separately.)

The price of the kit, sent postpaid to any address east of the Mississippi River, is \$6.95. For 50 cents extra, you can also have the five main hull pieces or "lifts" sawed to the correct shape, if you do not wish to draw the necessary patterns and do the work yourself. This new kit is marked *E* in the list below, which gives all the kits now available. Instructions or blueprints accompany each one.

No. 1. Colonial maple butterfly table with oval top 17 by 22 in., and 22½ in. high. Ready to assemble.....\$6.90

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble..... 5.90

No. 3. Tilt-top coffee table in selected maple with top 19 by 28 in., and 21 in. high. Ready to assemble..... 7.15

No. 3A. The same table in solid mahogany. Ready to assemble..... 8.15

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¼ in. high over all. Ready to assemble..... 5.30

A. Whaling ship model *Wanderer*. All the raw materials—wood, wire, fishing line, chain, celluloid, and everything but the paints, together with Blueprints Nos. 151, 152, 153, and 154. The hull is 20½ in. long..... 6.90

B. Folding muffin stand in selected sugar pine, 11 in. wide, 19 in. long and 33 in. high when open. All the necessary wood cut to approximate sizes but not machined... 2.90

C. Same muffin stand in birch (can be finished as maple, walnut, or mahogany) 2.90

D. Spanish Galleon ship model, 24 in. long. All the raw materials (except paints), Blueprints Nos. 46 and 47, and a booklet... 6.45



KITS BAND C



KIT A



NO. 2



NOS. 3 AND 3A

E. Battleship model, U. S. S. *Texas*, 3 ft. long. All the raw materials (except paints) and Blueprints Nos. 197 to 200..... 6.95

Popular Science Homecraft Guild,  
381 Fourth Avenue, New York, N. Y.

Please send me the following kit or kits, for which I inclose \$..... (or send C. O. D. ☐)

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All prices are 50 cents higher west of the Mississippi River because of heavy shipping charges. This offer is made only to readers in the United States.

Name .....

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(Please print name very clearly.)



KIT E



## BIG GAME HUNTING WITH A MICROSCOPE

(Continued from page 43)

might think they were revolving. Hence the name, wheel bearers. There is a purpose to this motion; by means of it the little creature brings food to its mouth. The polyzoons travel by looping their bodies like caterpillars.

We cannot afford to miss the diatoms—tiny bits of vegetation usually found in the greenish scum in the bottoms of pools. So many forms do diatoms take that men have spent their lives peering at them through microscopes and trying to classify them.

**T**HE diatom is circular and is really a one celled plant enclosed in a flinty, hard shell. It is constructed on the principle of the pill box, a slimy secretion covering the exterior of the cell wall and permitting the plant to slide quietly and serenely along. We shall also find fossil forms of this life, the live ones being colored green with nature's most abundant paint, chlorophyll.

As we examine the little bit of water brought up out of the pool, we shall see many, many things that have not been mentioned in this article. We must recall that the population of the sub-world is almost as cosmopolitan as it is great. After all this is an excursion, not an expedition. If the curiosity of the serious student is whetted, he is referred to his local library where he will find many books on microscopy and the life of the invisible world.

As time goes on, we shall want to extend our operations and sooner or later we shall have to have a sort of butchering table upon which to remove the various parts and viscera of beetles, flies, and spiders.

For this work we shall have to make what is known as a dissecting microscope. The first thing that we shall need is a fairly powerful pocket lens. No definite specifications either in magnifying power or physical form will be given but I would advise getting the best you can afford. A small mirror, such as women carry, will also be needed.

The builder need only follow out the directions contained in the simple drawing on Page 47. There is nothing critical about this machine save the mounting of the mirror and care should be taken to see that this is at exactly forty-five degrees.

**T**HE little standard in which the pocket lens is held will vary. The matter of mounting the lens will have to be left to the ingenuity of the reader. Of course, it should be mounted in perfect focus unless adjustment is provided for.

Cigar box wood is used along with tiny brads and a good grade of glue. The slanting members at each end of the machine are hand rests and it will be found well to include them.

In shaping the metal standards for mounting the magnifying glass, the builder should take care not to use too thin a piece of brass. If too thin, the lens will vibrate and interfere with vision.

The glass for the table top is held in place with tiny brads. Great care is needed in driving these in place for fear of breaking the top. If the builder wishes, he may use a good form of cement and so avoid the risk incident to the use of brads.

Just one more caution: we must not forget to measure the focal distance of the magnifying glass before we mount it in position.

**N**EXT month, you will be taken on another exciting journey into the mysterious microscopic world which, without a powerful glass, we could never hope to see. Don't miss this feature in POPULAR SCIENCE MONTHLY for February, on sale Jan. 3.

## Just as EASY as it looks

to become a popular musician  
this simple A-B-C way

**S**TOP cheating yourself out of musical good times. Stop thinking that learning music is nothing but one grinding session of monotonous exercise after another . . . days, months and years of difficult technique under the thumb of a private teacher.

Take a look at the above diagram. Looks easy, doesn't it? Well, it's every bit as simple as it looks. First a note, then a letter. Plenty of clear instructions tell you how each bar is played—lots of diagram pictures show you how, then you do it yourself and hear it. Everything to make learning a joy. In fact, the U. S. School of Music has made the reading and playing of music so simple that you don't have to know one note from another to begin.

Your first thrill comes with your very first lesson. For you are given a piece with a real melody to play by actual notes. Dreamy waltzes, stirring marches, sparkling sonatas follow in short order. No standing still. You become a capable performer months sooner than you could ever expect to by the old-fashioned way. Besides, you receive all the music you need at no extra cost.

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### QUESTION: What Shall I Give Him? ANSWER: See Inside Page of Back Cover

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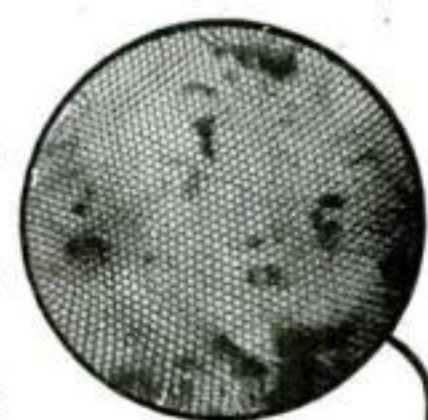
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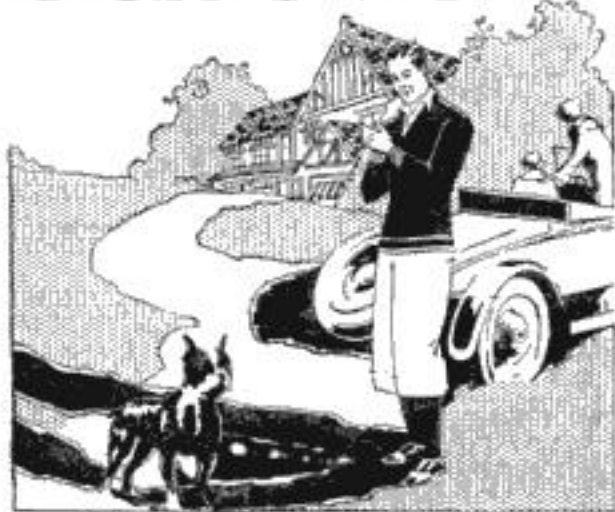
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# Secrets of Success

STORIES THAT WILL HELP YOU GET AHEAD

## Success—



while you are young enough to enjoy it

"I'm meeting Armstrong this afternoon at Ingleside—last chance for a little golf before we sail for Europe on the fifteenth..."

Pretty soft for Bob Carrington, you say—a lovely country home, golf on a week-day when the other boys are slaving at the office—a six weeks' trip to Europe with the family—and all this wonderful success while he is still young enough to enjoy it!

But why look with envy upon success well earned—especially when it is within your power to attain that same success?

"If men in business only realized how immensely valuable are those early years, and how vital it is to get away to a flying start, they would make it an inflexible rule to devote several evenings every week to home-study training."

One of America's foremost business men—an active director in a dozen big corporations—made that statement recently; and if you have the slightest doubt of its truth, you need only check it by the actual records of LaSalle-trained men, many of whom, though still in their thirties, are commanding five-figure salaries.

### Send for Free Information

"I'm determined to succeed," you say—and we do not deny that hard work and day-to-day experience will eventually win some measure of success. If success is sweet, however, is it not doubly sweet if it comes while you are still young enough to enjoy it?

And is it not a tragic waste of years to continue at outgrown tasks, simply because you will not spare the time to master those bigger jobs that command the real rewards?

Ten Years' Promotion in One is a booklet that shows you how you can save years that would otherwise be wasted—and the coupon will bring it to you FREE.

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## FAMOUS FIREARMS EXPERT STARTED AS A "COP"

**F**ORTY years ago William A. Jones threw his few and simple belongings into a suit-case and left home for New York. For him, as for so many boys raised on a farm, the great metropolis held a glamour and a promise of success that he could never expect to gain in the small country town where he lived.

One day the late Theodore Roosevelt, then Police Commissioner of New York City, was down at headquarters, examining a fresh group of applicants for jobs. One man immediately caught his eye and filled it, too—for he was a big, broad-shouldered chap with a ruddy glow to his cheeks. Roosevelt could read character at a glance. He liked this man's rugged face; his steady and honest gaze.

So William A. Jones became a policeman. But he was no ordinary policeman, content merely to patrol his beat day after day, month after month. The records of the New York Police Department testify to the qualities that set him apart from the rest of the "rookie cops" who first donned their uniforms at that same time. New York at the time was the Mecca of desperate criminals from all over the country. Organized gangs whose members would commit murder for a few paltry dollars infested the city. Jones set out to combat the forces of crime, not merely with the nightstick, which, in his powerful hand, was a mighty weapon, not merely with the authority of the law, represented by the buttons and shield on his broad chest, not merely with his magnificent courage—but with intelligence. Citation after citation for conspicuous bravery, for extraordinary police work of every sort came to Patrolman Jones until at last his superior officers decided to give the talents of this remarkable young cop a larger outlet, and he was made a detective.

**H**ERE was Jones's big opportunity, and he embraced it fully. He was a crack pistol shot and deeply interested in firearms, and he saw in the scientific study of firearms a way in which he could add to his usefulness as a police officer. He was, of course, on duty continuously. Yet somehow he made the time to pursue the course of study he had laid out for himself. Promotion came to him; he became a captain of detectives. To his ordinary duties was added the job of conducting the school of marksmanship for New York police, yet he always found time to pursue his studies, which led him into intricate technical paths—ballistics, or the science of projectiles; chemistry and metallurgy as they apply to the manufacture of ammunition and the steel used in gun barrels; photography; microscopy.

William A. Jones is no longer a policeman. He is today one of the country's foremost (Continued on page 87)



## Drafting and Design

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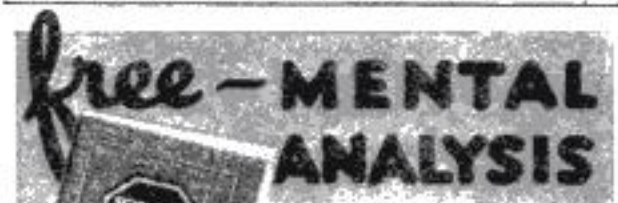
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## Secrets of Success

### FAMOUS FIREARMS EXPERT STARTED AS A "COP"

(Continued from page 86)

authorities on firearms. Show him a spent bullet and he can tell you everything about the gun or revolver that fired it, except the name of the man who pulled the trigger! Police departments and prosecutors all over the country are constantly calling on him for consultation or opinion in criminal cases in which the identification of a gun or bullet is of extreme importance. He has devised ingenious machines to help him read the secrets of bullets and guns and to demonstrate to courts and juries the secrets he has found.

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The story begins many years ago in Vienna, Austria, where Ralph Hitz was born. Although he is but a youngster, his father is already planning for him a career as an architect. One day he is taken to dinner at a fine hotel in Vienna. In the doorway of the restaurant stands a faultlessly groomed man, clad in spotless evening dress. He is by far the most important looking man Ralph has ever seen. No architect could ever look like that, he thinks. So Ralph decides that he, too, will be a head waiter.

Next summer he ran away from home and was found working in that same hotel as an elevator boy. At fifteen he was taken to New York by his father, who was on a business trip. Two days after they landed he disappeared—in a strange city, in a country whose language he could not speak! The frantic father was about to call in the police when his son turned up, beaming. He had found a job as a bus-boy in a cheap restaurant. He was making \$3.00 a week and he was happy. Ralph was cold to protests, threats and pleading. The father went back to Vienna without his son.

He held that job for a year and then he decided to see his adopted country. He went to Baltimore and promptly got shanghaied as a cook aboard an oyster boat. They were glad to get rid of him. His cooking was abominable. Ashore again, he worked his way West, coal mining in West Virginia, peeling potatoes in Chicago, scrubbing floors in St. Louis, and washing dishes in Denver. Soon, he was sure, he would (Continued on page 88)

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National Radio Institute, Dept. 3AP3  
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## Secrets of Success

### BUS-BOY TURNS HIMSELF INTO HOTEL MANAGER

(Continued from page 87)

be a head waiter.

But as he saw more of hotels his desire changed and he set his heart on becoming a hotel manager. By this time he knew the mechanics of hotel and restaurant work. Now he began to study the customers; learn why guests preferred this hotel or disliked that one.

Up the line he went. In 1917 he came to the Gibson Hotel in Cincinnati. He had been there before—twelve years ago—as an assistant head waiter. Now he returned as managing director. The hotel had been losing money steadily. He looked over the books. "Do you think you can put it on its feet?" the owners asked.

"I'll make \$150,000 for you the first year," he answered. When the year was up, auditors went over the books and reported a profit of \$172,000.

The New Yorker was built in what is considered a poor hotel location, and it was finished just as bad times set in. Managing it was considered the toughest hotel job in the country. Ralph Hitz, starting cold, made an operating profit of over a million dollars his first year.

What does he think of this field as a young man's career? Great, he thinks. But it's one business that must be learned from the bottom up, as he did. It's a career that promises success only to those who are willing to work harder and to give more service than is expected of them. That is a short summary of Hitz's theory, and no one can deny his success!

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## HOMEMADE CHASING DIAL FOR A LATHE

(Continued from page 71)

The attachment hangs on a 5/16-in. stud at the upper margin of the flat spot and well forward of the center of its mass. When released by the clamping screw at its center, the device hangs vertically and disengaged; but when tilted forward to the limit of the elongated hole at the clamping screw, the dial assumes a position of greater visibility to the operator and the wheel engages the screw, where it is locked for use.

It will be clear that when the indicator is engaged for chasing threads with the screw driving the carriage through the split nut, the dial is stationary; for the worm wheel, advancing with the carriage, also advances with the helix of the screw and so does not rotate. Whenever the nut is opened, however, and either screw or carriage moved, as when returning after each successive cut, the wheel rolls against the screw and the dial indicates the altered relationship.

Measured on this particular indicator, 1/2 in. of carriage travel rotates the dial one eighth revolution or one mark, for there are eight threads per inch on the screw and 32 teeth on the worm wheel (one turn of the wheel for each 4 in.). If one can imagine the thread to be cut laid against the lead screw as in the diagram on page 71, it will be seen that only at those points where the two threads are coincident can the nut be engaged. On multiples of the lead screw, the nut can be closed at random; for all even threads (those divisible by two), on any line of the dial; and for odd threads, on any numbered line. For half threads (as 11 1/2), close on lines 1 and 3, which correspond to 2-in. intervals.

## CAST-OFF DENTAL TOOLS SERVE MANY PURPOSES

FROM your dentist you can obtain many tools and instruments, broken or otherwise, that may be converted into useful tools. Among these are worn-out burrs (drills), broken excavators, explorers, and elevators. As they are made from the finest steel, dental burrs serve as excellent wood drills from the size of a pin point to 1/4 in. A little work on the grinder will change these drills into a complete set of awls. Delicate gouges, reamers, nail sets, and screw drivers may be made from the larger instruments.

Sand and emery on linen strips can be obtained at low cost from any dental supply store in all degrees of grit. As these strips are about 8 in. long and up to 1/4 in. wide, they are ideal for intricate pattern or jig-saw work.—EUGENE UTZ.

## KEEPING PAINTBRUSHES SOFT FOR YEARS

Few paintbrushes used around the house wear out in service. At the end of a job, they usually are cleaned more or less thoroughly, then put away in a can of water, linseed oil, or turpentine and forgotten until again wanted, when the protecting liquid is often found to have evaporated, leaving the brushes as hard as a board and useless for painting.

The proper method, of course, is to clean the brushes perfectly and store them away dry, but few amateur painters will take this trouble. One home tinkerer, borrowing an idea from the kitchen, puts his brushes away individually in fruit jars filled with turpentine and seals them in by pouring a skim of melted paraffin over the turpentine to prevent evaporation. Brushes thus protected are as pliant after a year as the day they were put away.—ELTON STERRETT.

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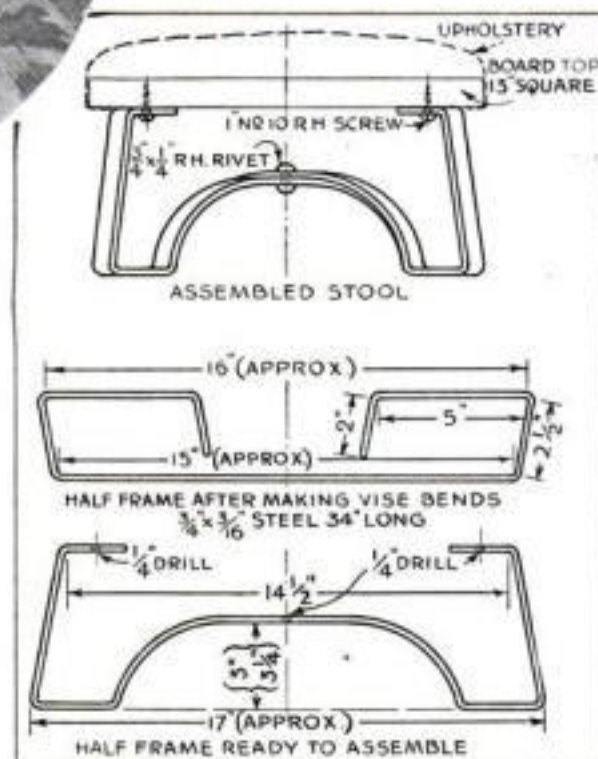
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## A FOOTSTOOL THAT WILL NEVER BREAK



The strength of this neat looking footstool lies in its steel frame. The top is a plain board well padded with either cotton or curled hair and covered with burlap and tapestry

An assembly drawing is given below, together with two detail views that show the steps in bending each half of the frame. Steel of this size can be bent cold without difficulty



**E**VEN if you have never attempted metal work before, you can easily make this sturdy, good-looking footstool. Its frame, as shown in the drawings, is made from two pieces of  $\frac{3}{4}$ -in. steel,  $\frac{3}{16}$  or  $\frac{1}{4}$  in. thick and 34 in. long.

The sharp bends are made in the vise with the aid of a heavy hammer. Stock of this size can be bent cold without difficulty. To make the center bends, catch one end in the vise and bend over by hand, then reverse the ends and repeat. The two halves are identical except that one is  $\frac{1}{4}$  in. higher in the center than the other.

Having made the two halves of the frame and drilled the three  $\frac{1}{4}$ -in. holes in each, rivet them together and attach them with screws to a 13 in. square board top. The top may be upholstered either before or after it is fastened to the frame, and the upholstery may be as simple or as elaborate as desired. A perfectly satisfactory top may be made by spreading evenly

over the board a thick layer of cotton or curled hair, over which is stretched a piece of burlap tacked on the edges of the board, and on top of this a piece of tapestry or other upholstery material, tacked under the edges.—LEE M. KLINEFELTER.

## SALT FORMS QUEER GARDEN IN A DISH

**T**ABLE salt moistened with bottle bluing and water sets up a strange sort of growth that eventually forms itself into tiny stalactites and stalagmites of exquisite beauty. If placed in a suitable container and provided with materials on and around which they may grow, the encrustations will develop into an artistic and unusual ornament.

The photograph illustrates a quaint miniature garden in a wide, deep glass fruit plate after two weeks' growth. Small rough stones are first arranged to form a tiny rockery sloping gently from the center of the plate towards the rear. A dry twig is set securely among the rocks at the back, and a small porcelain figure placed in front of the "tree." Twelve tablespoonfuls of ordinary table salt are then poured between and around the stones. Moisten the salt with 3 tablespoonfuls each of bottle bluing and cool water, and set the container aside in any warm room, out of the direct rays of the sun. Each day thereafter add about 2 tablespoonfuls of water, eased in gently from the end of a teaspoon or dropped with a medicine dropper. The aim should be to avoid wetting the growth on top or it will dissolve.

The second day a slight growth should be noticeable. Within a week it will have spread well toward the outer edges of the



This curious dish garden was "grown" by adding bluing and water to ordinary table salt

container and up and over the surfaces of the stones, onto the ornaments. The porcelain figure can be kept free of growth by letting the daily application of water trickle down over the form.

Instead of a garden, a "pillar of salt" may be preferred. In a deep plate or a shallow glass bowl, stand a china doll, kewpie, or mermaid 5 or 6 in. high. Add the salt, bluing, and water as before.

Various tints and tones may be produced by adding 3 or 4 drops of vegetable coloring, colored inks, or water colors to the moistened salt.—M. INEZ HOLDEN.



## HOW TO LOCATE YOUR CAR'S MOTOR KNOCKS

(Continued from page 58)

Benson, intent on learning all he could. "The best way is to take the car out on the road and drive it along about fifteen miles an hour; ordinary motor noises don't speak up so loudly at that speed. I generally include a few hills in the ride too."

"If I hear a light knock that gets louder when the car climbs a hill, I know that it can be either carbon, loose piston rings, or a loose piston. If the knock has a muffled sound, I mark it up against a worn connecting rod. A pounding engine sometimes means a worn crank-shaft bearing. In your case, it meant that something was loose outside the motor."

"But that's all guesswork," Benson objected. "Isn't there some way you can tell for sure just what the trouble is?"

"An auto mechanic," smiled Gus, "is like a detective. He doesn't make any accusations until he's pretty sure. A little brain work in the beginning will save a lot of expensive tool work later on. You've got to go about things systematically and find the trouble by eliminating one possibility after the other."

"AFTER a good mechanic gets some hunch by using his ears, he can generally run down the actual trouble by making common-sense tests. For instance," Gus led the way to a car parked by the repair bench at the back of the garage. "I took this car out for a test run yesterday and from the noises it made I decided a connecting rod was loose."

"Now I'm going to test the bearings by running the motor at idling speed and short-circuiting the spark plugs one at a time."

He picked up a rubber-handled screw driver and shorted the cylinders in turn.

"Nothing's happened so far," he said, placing the shank of the tool on the third plug, "but listen to this one."

When the engine was running with all cylinders, a definite metallic knock could be heard, but when Gus cut out one cylinder by shorting the spark plug, the noise got fainter and changed to a double knock instead of a single rap.

"That's the cylinder," announced Gus. "Now I won't have to bother about the rest. You can always locate bearing or piston trouble by cutting out the explosions on the cylinders one at a time. A difference in the sound of the knock will generally tell you that the short-circuited cylinder is the one causing the trouble. Of course, two or more cylinders may be at fault, but you can generally sort them out by repeating the test several times."

"WHAT do mechanics mean when they speak of 'piston slap'?" Benson asked when Gus had closed the hood on the car.

"That's a knock caused by a worn piston hitting against the side of the cylinder at the beginning of each power stroke," Gus explained. "You can generally spot the right cylinder by short-circuiting. If the knock stops when a particular cylinder is cut out, that cylinder contains the worn piston."

"Piston slap is a funny thing, though. A cold motor will often have a piston slap that'll disappear when the motor heats up and the parts expand. If it's a real case of piston slap, all you can do is pull down the motor and fit oversize pistons and see that the connecting rods are properly aligned."

When Benson had dropped Gus off in front of his house, the old mechanic looked over his shoulder and smiled. "I wouldn't worry too much about all the squeaks and rattles you hear when you're driving a car," he said. "A motor's bound to make some noise when it gets old. But it's only the queer thumps and knocks that mean real trouble."

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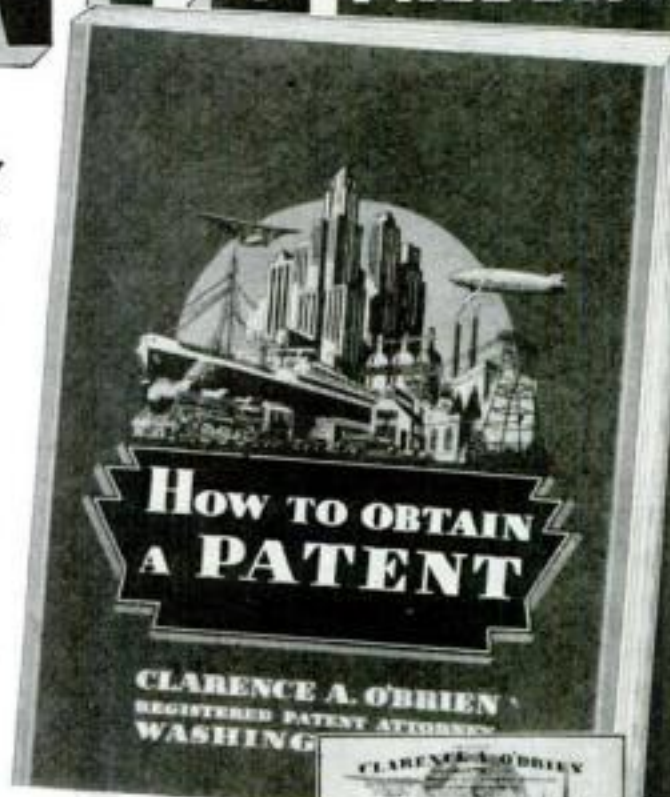
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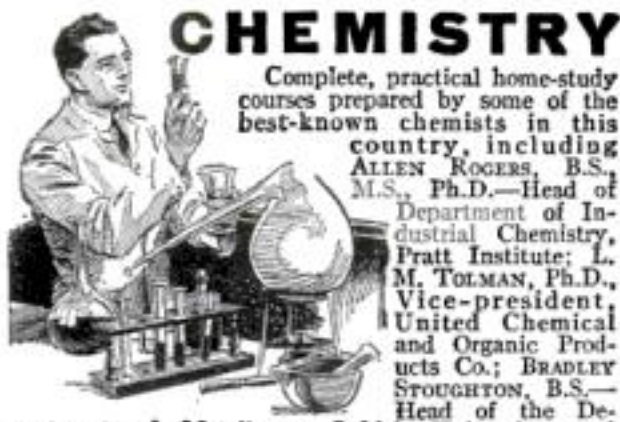
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## PICKED MEN TRAINED TO LEAD SEA POLICE

(Continued from page 30)

dope smuggler is also active. Armed with smoke screens, machine guns, super-powered boats, and even poison gas, these outlaws are playing a fierce but losing game with the law. Against these smugglers, the little sailing cutters of the old days have given way to a fleet of several hundred swift picket boats, sturdy steel cutters with turbo-electric drive, sixteen powerful destroyers. Seven brand-new, 165-foot Diesel-powered patrol boats were recently added to this service in the vicinity of New York. An ever-tightening cordon is being drawn around our 10,000 miles of coast.

Capture of the rum-runner is only one of many duties of the Coast Guard. More than 300 wrecks, derelicts, and other dangers to navigation are destroyed each year by ramming, gunfire, or explosives. Laws relating to navigation, quarantine, and neutrality must be enforced. Medical aid is rendered to vessels engaged in deep-sea fishing. Regattas and marine parades are patrolled. Protection is given to seal herds, game, and salmon fisheries in Alaska. Medical attention, police protection, provisions, and legal services are carried to isolated villagers of the far north.

SINCE the fateful night in April, 1912, when the *Titanic* rammed an iceberg off the Grand Banks and sank with the loss of 1,500 lives, two cutters have been detailed each spring to patrol the danger region, noting the size, position, and drift of icebergs floating near the shipping lanes, and broadcasting the information to passing vessels. From 1,500 to 2,000 ships, \$10,000,000,000 in property, and 1,000,000 lives pass through this zone each season. Due to its watchfulness, not a single ship has been lost by collision with an iceberg since the patrol has been in operation.

Most important of all the duties of the Coast Guard, however, and the one pursued at the expense of all the others when occasion demands, is the rescue of lives and ships. To this end, every officer must be a hero as well as expert seaman. From December to March, the most hazardous months of the year, cutters of the service continuously plow through the danger areas, alert for the call of a disabled ship. More than 250 active land stations, with launches and surf boats ready to push into the waves, keep watch from the shore.

During the fiscal year ending in 1931, the officers, cutter crews, and surfmen assisted vessels and cargoes worth \$47,959,465, and saved 5,627 lives. During the last eighteen years, the value of property saved is more than \$600,000,000 and more than 50,000 persons were rescued.

ON TWO recent trips to New London I saw the buildings of this institution, talked with the members of the faculty, and saw the cadets hard at work. Of Colonial design, faced with brick and limestone, the buildings have been adapted to the configuration of the land. In the front row, facing away from the river, are the classroom and administration buildings and the cadet barracks. Behind these, lower on the slope, are the machinery building and the enlisted men's quarters. The combined armory and gymnasium, and the athletic field overlook the river and wharf.

Captain Randolph Ridgely, Jr., is the first superintendent of the new Academy, coming to the position from the command of the New York Division of the Coast Guard. Captain Ridgely served in the World War, in the submarine zone.

Captain Q. B. Newman, for many years Engineer-in-Chief (Continued on page 93)

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## PICKED MEN TRAINED TO LEAD SEA POLICE

(Continued from page 92)

of the service, is head of the engineering department. It was Captain Newman who introduced the turbo-electric ship to the Coast Guard and made the equipment lighter and more efficient by substituting a synchronous motor for the customary induction motor. It was he, also, who devised a system by means of which the load generally maintained by a ship's auxiliary generators could be transferred to the main driving generators when the vessel was under full way, thus deriving the greater economy of a central power plant.

The regular classrooms of the Academy differ little from those of the average college, but many of the rooms in the engineering building are unique. There a cadet runs lathes and milling machines, Diesel engines and turbines, electric motors and dynamometers. In a room fitted to duplicate exactly the boiler room of a regulation cutter, he learns the technique of firing and boiler regulation. On a reinforced stage in the engineering auditorium, heavy machinery may be hoisted out and explained and demonstrated before a large study group.

IT IS the course, however, that distinguishes the Coast Guard Academy from both the ordinary nautical school and the college or university of the outside. Beginning and ending with seamanship and marine engineering, it nonetheless covers practically all the cultural ground of the average college and all the discipline, arms practice, and tactics of a military institution.

From the end of September until the beginning of June, the cadet spends his days studying the elements of seamanship, engines, navigation, ship construction, thermodynamics, mathematics, ordnance, electricity, English, French, navigational law. From the beginning of June until the end of August, he gets a chance to put the knowledge gained into hard practice on the sea.

On the annual practice cruise, of which there are three, he learns to swab decks, fire the engines, handle guns, navigate, and finally to command the cutter on which he sails. Every duty aboard the ships of the practice squadron is performed by cadets. Gun drills are held almost daily. Boats are lowered for rowing practice on rough seas. Before a man is graduated from the Academy, he is expected to carry out all the responsibilities of navigating officer and of officer of the deck.

THE \$780 a year pay of the cadet of the Coast Guard is the same as that of the midshipman at Annapolis, and is enough to provide all uniforms and sustenance, and allow a little spending money. Upon graduation, he is commissioned by the President of the United States as an ensign of the U. S. Coast Guard—a rank equal in pay and status to that of the similar rank in the Navy. He then receives \$1,500 as his base pay, with several hundred dollars more for allowances.

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## HOW MODERN SURGEONS CONQUER FATAL GERMS

(Continued from page 24)

Sometimes, such emergencies come like flashes of lightning.

In Birmingham, Ala., a few months ago, Dr. T. H. Williams was in the midst of a delicate abdominal operation when he clutched his left side, gasped, "Doctor, take care of my patient!" and dropped dead of a heart attack. In spite of his shaken nerves, his assistant, Dr. R. M. Coston, finished the operation successfully.

Again, in Kansas City, Mo., recently, a surgeon was finishing a night operation for appendicitis when he himself was stricken with an acute attack. He collapsed beside the operating table and his assistant had to finish the work and then perform an emergency operation to save the life of his colleague.

Most dramatic of all was an occurrence, not long ago, in Berlin, Germany. The famous specialist, Dr. H. Sauerbruch, was operating on a twenty-two-year-old girl who had developed heart trouble after an attack of influenza.

**I**N THE right side of her chest, the X-ray showed a large swelling. Shortly before, the surgeon had found a similar swelling in a man's chest. It proved to be a blood blister which he had punctured and successfully eliminated. Planning a similar operation on the young woman, he made his incision and cautiously jabbed his needle into the swelling. Nothing happened. A second time he jabbed, this time with greater force. Instantly, a thick bloodstream poured out, rapidly widening the opening. Instead of a blister, the swelling was a blood-pouch of the heart itself!

Frantically, Sauerbruch sought to stop the rush of blood. Plugging the opening with his finger, he could feel the lifestream within the right ventricle virtually boil and bubble. In the wink of an eye, the operation had become a two-man job, impossible to complete without the aid of his assistant. While he closed the hole as best he could, the assistant placed the stitches, Sauerbruch gradually removing his finger as the opening drew together until it was completely closed.

A curious climax to the case is the fact that the patient not only recovered but is in vastly better health due to the elimination of the blood pouch. Had the surgeon known what the apparent blister really was, he would never have dared operate. His mistake in diagnosis cured the girl of heart trouble!

When an operation is over, the fight against infection continues as actively as ever. Sterile bandages keep germs from reaching the wound and, when pus is present, drainage tubes carry it away. Until the Battle of Turin, in the Sixteenth Century, boiling oil used to be poured into wounds to hasten healing. At this battle, the oil ran out and surgeons discovered to their amazement that wounds which were *not treated* in this way healed quicker than those that were. Lister, in one of his later experiments, used to place bunches of horsehairs, treated with carbolic acid, in wounds, removing the hairs a few at a time as the opening closed in healing.

**O**NE of the most important medical discoveries in recent years is the use of surgical maggots in curing chronic infections. During the World War, two soldiers who had been injured by shellfire lay in a thicket for seven days before they were discovered and brought to the base hospital. When Dr. William S. Baer, famous Johns Hopkins surgeon, examined their wounds, he found a remarkable thing. The larvae of blow-flies in them had kept the wounds clean, consuming dead tissue, preventing infection and setting up a healing action.

After the war, Dr. Baer carried on a series of experiments with carefully-bred sterilized maggots. With them, he achieved remarkable success in treating almost incurable bone infections, compound fractures of the thigh, and tuberculosis of the hip. Out of 200 cases treated at the time of his death in 1931, he had achieved ninety-five percent cures among children and eighty-five percent among adults. Since then, his method of treatment has been widely adopted.

Not only is it important to give careful attention to the outside of a wound to prevent infection, but also the circulation of the blood to it, purifying it from the inside, must be unimpaired or gangrene is likely to set in. At the famous Mayo Clinic, at Rochester, Minn., not long ago, a remarkable bit of surgery saved a patient from this dread form of infection.

**A** HOTEL guest awoke in the middle of the night with a stabbing pain just above his left ankle. It felt as though the bone were dry and about to break. His foot was numb and black and brown blotches were beginning to appear on his leg. Thoroughly frightened, he called the hotel physician, who diagnosed the mysterious trouble as a blood-clot in the main artery of the left leg. Unless the clot could be removed, allowing the blood to flow freely to the leg again, gangrene would putrify the flesh and amputation would be necessary.

The suffering man was rushed to the Mayo Clinic. Here, one of the famous surgeons of the staff made a tiny slit, only an inch long, at the point where the obstruction was located. Clamping the artery to prevent bleeding, he cautiously pushed his scalpel blade through the wall and with deft fingers removed two large clots. When the artery had been securely sewed up with surgical silk, he removed the clamp. Once again, blood flowed through the limb. Immediately its condition improved and in a short time the patient was out of bed.

For permanent stitches in arteries and intestines, sterilized silk is used. In places where tissues will grow together, catgut, which dissolves and is absorbed by the body, is employed. These catgut threads, or sutures, are timed to dissolve in eight days, ten days, twenty days, and forty days, the surgeon choosing the type that will hold the tissues together just long enough for them to knit. The sutures withstanding the action of the chemicals of the body longest are ones which have been tanned by the process that produces chrome leather.

**I**N SURGICAL sewing, it is important to injure as little of the tissue as possible. Instead of being threaded through an eye, the catgut is attached directly to the needle, one end slipping into its hollow rear and being crimped in place. Thus the hole made in the tissues in sewing is the diameter of the thread instead of twice that, as would be the case if an eye needle were used. The sutures come, with the needles attached, in hermetically-sealed glass tubes, some straight and some shaped like little canes. These tubes are broken and the sutures extracted as they are needed during the operation. When the work is done, the needles are clipped off and thrown away.

All surgical catgut comes from the intestines of sheep with the exception of a special, super-strong variety used in tying bones together. This is obtained from the tail tendons of kangaroos. In small skin wounds, where there is little tension, horsehair is sometimes employed as surgical thread. Clips are now widely used in (Continued on page 95)



## HOW MODERN SURGEONS CONQUER FATAL GERMS

(Continued from page 94)

place of sutures in holding together many kinds of external wounds.

One of the queerest cases I remember in which a makeshift suture saved a life, occurred, a few years ago, five hundred miles at sea. A young doctor had shipped at the last minute as surgeon on a dilapidated, cut-rate steamer, carrying 900 passengers. The ship was past Sandy Hook, heading for England, when he examined his equipment. He found there was no operating room, no sterilizing equipment, and only a few out-of-date surgical instruments on board. Then, five days out, one of the passengers collapsed with an acute attack of appendicitis!

The captain informed the surgeon he could operate wherever he pleased. He chose the smoking room and had it cleared. Draping sheets around two card tables in one corner he formed a booth which he disinfected with formalin lamps.

AN OLD Russian apothecary on board administered the anesthetic. Just as the patient was going under, the doctor discovered all the sutures were rotten and would break at the slightest touch! Was there a violin on board? The chief officer dashed upstairs and returned with the skipper's fiddle. Tearing off the E-string and sterilizing it, the surgeon used it for catgut to sew up the wound at the end of a ninety-minute operation which resulted, miraculously enough, in the patient's complete recovery.

A HUNDRED years ago, a patient needed superhuman courage to undergo an operation for he was conscious while the surgeon worked and had to bear the pain as best he could. That is no longer true. The discovery and use of anesthetics is a thrilling chapter in the story of modern surgery. Next month Dr. Damrau will tell what an anesthetic is, how it is administered, and the effect it has on the patient. Also he will describe amazing operations performed with its help. See POPULAR SCIENCE MONTHLY for February.

## HOW YOU CAN TALK OVER RADIO TRANSMITTER

(Continued from page 55)

crophone is connected by means of a separate circuit, which consists of a microphone, a battery, and a transformer. Any variations in the resistance of the microphone will then cause more or less current to flow in the primary of the transformer.

With grid-bias modulation, the microphone circuit is so connected that variations in the microphone resistance, caused by sound waves, set up an audio voltage which is alternately added to and subtracted from the normal grid-bias voltage. This audio-frequency variation of the grid bias then causes corresponding changes in the antenna current.

In the plate voltage modulation system, the microphone is so connected that the plate voltage is varied in a similar manner. These changes in plate voltage then cause corresponding changes in the antenna current.

In both methods, the additional microphone circuit is operated to alter a control voltage and upset the normal operation of the vacuum tube.

Unfortunately the power that the microphone circuit can add to the plate circuit is small. This necessitates the use of a suitable amplifier for the audio-frequency power.

NEXT month, Mr. Carr will continue his discussion of modulating systems and give valuable pointers for adapting the transmitter you have for radio telephone operation.

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ALL-WAVE, 15 to 550 METER tuning range brings the whole world of radio to your home. Not only U. S. stations from Coast to Coast, but, when radio conditions are favorable, you can tune in London, Paris, Berlin, Rome and hundreds of foreign stations using short or long wave. The Midwest super "16" has four distinct wave bands. . . . police, amateur, long wave, short wave. And it gives you marvelously clear reception. . . . better than 7-1/2 KC selectivity. With the wonderful new matched dual speakers, tone control and STAT-OMIT tuning silencer, you will enjoy sensationally clear and smooth radio reception such as you have never known. And above all you will enjoy absolutely faithful tone reproduction. Thousands of Midwests are giving wonderful satisfaction in every state of the Union and forty-nine foreign countries as well. No radio at any price can give you better reception than this famous Midwest which you buy direct from the factory at a sensationally low price.

### Read These Letters!

"Am having good results with my 16-tube Midwest. On the short wave I have had most all of the large stations. I get several of the Airport Stations and amateur stations a plenty. Had G5SW, LEX, Buenos Aires, VK2ME, VK3ME, Sydney, VE9GW, Bowmanville, Canada, Pointoise, France and Nauen, Germany." R. P. Reynolds, P. O. Box 1125, Orlando, Fla.

"The 16-tube radio arrived yesterday, got it going today and to express myself in a few words, . . . What a radio! What a tone! What a surprise! Really, it is more radio than I ever dreamed of seeing incorporated in one chassis. It's wonderful. L. P. Kimmell, 7324 Wakefield Ave., Cleveland, Ohio.

## Deal Direct with Factory! SAVE UP TO 50%

Midwest sweeps aside the costly old-fashioned way of selling through jobbers and dealers. You buy direct from the factory. You have 30 days trial in your own home and a positive guarantee of satisfaction or money back. If you wish, you may pay for your Midwest in small monthly sums that you'll scarcely miss. Remember. . . . only \$10.00 down puts even the biggest and finest Midwest in your home now. Some models as low as \$5.00 down.

Investigate! Mail the coupon. Get the Midwest catalog. Learn the facts about Midwest 12 and 16-tube ALL-WAVE sets. Get a bigger, better, more powerful, better toned radio—at a positive saving of 30% to 50%. Mail the coupon or write us a postal right NOW!

**MIDWEST RADIO CORP.**  
 Dept. 165 (Est. 1920) Cincinnati, O.

### Four Sensational New Midwest Features

Midwest 1933 ALL-WAVE radios have all the worthwhile improvements and many exclusive Midwest features. Outstanding among the important advantages of these big powerful sets are these:

**STAT-OMIT Tuning Silencer**  
 An inter-station silencer or noise suppressor that automatically omits all in-between-station noises, swishing, crackling and frying. This new method gives perfect tuning without Neon lights, visual meters or buttons formerly required.

**Class "B" Amplification**  
 Gives absolutely faithful reproduction of all tones and overtones. Enormous reserve power capable of reproducing any instrumental combination of the most powerful orchestra. Handles the full volume of the largest pipes of the grand organ.

**Dual Speakers**  
 Two full electrodynamic speakers for complete audible tone range, especially designed for the tremendous power output of the new tubes.

**One Chassis—One Dial**  
 Only one chassis for everything, 15 to 550 meters. . . . regular broadcasts, police, amateur, ships at sea, commercial stations, foreign shortwave broadcasts. No converter or other auxiliary units used. All bands controlled by one dial.

**TERMS as Low as \$5 DOWN**

### COMPLETE LINE OF NEW CONSOLES

The big new Midwest catalog shows gorgeous line of artistic consoles in the new six-leg designs. Mail the coupon now. Get all the facts. Learn how you can save 30% to 50% on a big powerful radio.



**RUSH THIS COUPON FOR AMAZING FREE TRIAL OFFER AND BIG BEAUTIFUL CATALOG**

**Midwest Radio Corp.**  
 Dept. 165  
 Cincinnati, Ohio.

Without obligation on my part send me your new 1933 catalog, and complete details of your liberal 30-day free trial offer. This is NOT an order.

**USER AGENTS EASY EXTRA MONEY**  
 Check here for details. ☐

Name.....  
 Address.....  
 Town..... State.....



# Auto Stealing Now \$50,000,000 Racket

(Continued from page 15)

duplicate keys for starting the car he picks out.

There are three ways in which thieves handle a "hot car" after they steal it. They may hide it until the storm blows over; they may "scramble" it and then try to sell it; or they may attempt to dispose of it immediately.

A year or so ago, a brand-new sedan which had been driven only five miles was stolen at Portland, Oregon, and appeared again the following spring. It had been hidden under hay in a barn during the winter. Capt. Dillon, told me of another case in which a thief in upstate New York was so frightened by his near capture that he left the machine he had stolen under hay in a barn for nine months. When he brought it out, rats had eaten away the whole top. But it had been on the road only a week when police arrested him! Usually gangs try to dispose of their stolen machines in rural communities where they are less likely to come to the attention of the city police.

In "scrambling cars," a number of machines of the same make and model are stolen at the same time. In some underworld garage, they are then torn apart. Wheels are switched, transmissions shifted, bodies changed, and engines transferred from one car to another. In one case, twelve machines of the same design were taken apart and scrambled by a New York gang to hinder identification. A special garage, midway between New York City and Philadelphia, Pa., used to be used for altering and scrambling stolen cars.

**S**OME gangland mechanics are past-masters of camouflage. There is one instance actually on record in which a country storekeeper bought his own machine three times! A gang stole it, camouflaged it and sold it back to him twice. He finally grew suspicious when his pet dog appeared to recognize the car, jumping up into the seat as soon as it was driven into the yard.

If the trained experts of the automobile squads can examine a machine thoroughly, they can identify a stolen car in spite of the most cunning camouflage. They have at their disposal secret means of identification unknown to the ordinary officer. By means of special asbestos sheets and blowtorches, they can bring back altered numbers on motors. In Los Angeles, Calif., a system of "finger-printing" auto tires to help track down thieves has been developed. Elaborate cross-filing systems and frequent check-ups of the motor numbers on registration lists provide valuable clues. In one western state, a few years ago, twenty-five machines were found registered with the same motor number!

Recently, thanks to the radio police cars which receive descriptions of stolen machines while cruising about the streets, the recoveries in large cities have mounted to approximately eighty percent of all the automobiles stolen.

Probably the most cunning stratagem of all was worked out by a lone wolf auto thief in New York City. It enabled him to dispose of twenty-one stolen machines before he was caught.

With his wife and baby, he would drive up and down the main streets of the city until he found a parked machine exactly like his own with an empty space either ahead or in back of it. Then, he would park his own machine in this empty space and all three would go into a store for a minute or two, come out and "by mistake" enter the wrong machine and drive away. A complete set of keys for that particular make and model permitted

him to open doors and unlock switches and transmissions. If the owner saw him, he would apologize for his error and get into his own machine, of identical appearance.

Another daring ruse is often resorted to by gangs to make a quick sale. After a machine of a particular make has been spotted, an advertisement is inserted in a newspaper offering for sale the auto which is yet to be stolen!

Those interested are requested to call a certain number. When they do, they are told the car will be parked at the appointed hour directly across the street from "our downtown showroom," giving the address of a leading dealer in that make of machine. The "hot car" is parked at the spot a few minutes before the customer arrives.

The customer is told a plausible story as to why the company across the street is able to sell the machine at a ridiculously low

authorized dealer until a motorcycle cop tells him to pull over to the curb and he learns he is driving a stolen car!

**D**URING the last two years, business conditions have given rise to another problem for the men of the automobile squad. Owners are hiring thieves to steal their cars!

The thief gets \$100 to destroy or alter the machine so it will never be recovered, while the owner, at the end of sixty days, collects his insurance in ready cash. In New York City, last year, a manufacturer and a storekeeper were caught dealing with such thieves. In both cases, the exposure ruined their credit and forced them out of business.

One authority with whom I talked, gave me the amazing estimate that twenty-five percent of all the autos reported stolen today are never stolen at all. The owners hide them, run them into swamps, or tear them to pieces and report they have been stolen to collect the insurance. Again, each year, hundreds of people who receive parking tickets try to escape paying the fines by telephoning headquarters that their cars have been stolen and then maintaining the thief had left the machines where they were given the tickets!

During one of my talks with an expert who is in charge of 200 trained detectives covering a dozen eastern states, I asked what simple precautions an owner can take to keep his machine from being stolen and how the purchaser of a second-hand automobile can spot and avoid a "hot car" when it is offered for sale. In reply, he gave me the following do's and don'ts, which I pass on to you:

*To keep your car from being stolen:*

- (1) Don't park it in the same place every day. This gives the thief a chance to study your habits or copy lock numbers and get keys to fit.
- (2) Never leave your car for any length of time unlocked. Seventy percent of all cars that are stolen were left unlocked by their owners. Automobiles with doors and switches or transmissions locked are rarely taken.
- (3) Be sure the windows are all closed tightly when you lock your machine. Rear windows, particularly, are often left down an inch or so without attracting the attention of the owner and provide a chance for the thief to get inside.
- (4) Never leave your car with the engine running even in your own driveway or when you intend to be in a store no longer than a minute. It takes but a few seconds for a thief to step on the gas and get away while your back is turned.
- (5) And, be especially on guard after dark when parking near theaters or other places of entertainment where you will be gone for several hours.

**TO AVOID purchasing a stolen car:**

- (1) Watch out when the seller wants cash instead of a check.
- (2) Take time to investigate when the price seems too low or when the seller appears willing to do too much for you.
- (3) Don't close the deal in a hurry. Wait a week before giving your final decision. Auto thieves can't wait; they have to sell in a rush.
- (4) Be on your guard when the seller gives as his reason for disposing of the car the fact that he has "gone broke in Wall Street" or has lost money on the races. These are stock excuses among auto thieves so don't take them at their face value.
- (5) And, finally, if you are at all suspicious, and live in a large city, call up headquarters and have the engine number compared to those on the list of stolen cars.

## Police Get a Loud Voice



**VIOLATORS** of traffic regulations at Stratford, Conn., are spoken to by the police in clarion tones that can be heard for a mile. A microphone and a loudspeaker on top of the police booth are used in directing the drivers on the four-lane express highway.

price. After a few minutes, the "salesman" says: "I like your looks. Wait a minute." He goes across the street into the showroom where the customer sees him talking to the men inside. In reality, he is asking if he can borrow a pencil or wash his hands. But, when he returns, he announces that "his partners" have agreed to an extra-special price for a quick sale. The buyer pays cash and receives the papers which have been prepared beforehand. His receipt is signed with a flourish, "vice-president,—Company." He never realizes he has not dealt with the



# "How Do I Know It's Christmas?"

(By A Man Who's Been Through It Many Times)

**E**VEN without holly and tinsel, trees and ornaments, I'd know it. One day—every year without fail—I walk into a room where there are a lot of packages marked for me. After they are opened, I find myself richer to the tune of one dozen neckties and two dozen pairs of socks. 'This must be Christmas', I say—and so it is.

"Now, I know that every Christmas present comes from the heart, but I'm practical and I wish they'd put a little more 'head' in with the heart. Neckties come in such astounding colors that I'd rather pick my own. And you can't do much with Christmas socks that are a size too large or a bit too small.

"Just let me put in a word for myself—and for a couple of million other men like me. We like Christmas presents, and we like to give them. But when we're on the receiving end of the exchange, it does our hearts good to get a really sensible gift—of practical and permanent value. Something that gives us enjoyment, something that reminds us of the giver—makes us think of him gratefully—six months—twelve months after Christmas has come and gone."

That's a frank, man's point of view. Isn't it yours? Aren't there men you know who you're dead certain feel that way? Wouldn't such a man say you used both *heart* and *head* when you sent him Popular Science Monthly for a year, as a Christmas Gift?

You know—without our telling you—what a delight Popular Science Monthly, with its fascinating news and amazing photographs of scientific progress all over

the world—can be to the man who wants and values a practical gift. When you make this gift—be he father, son, brother or friend—a year's subscription to this graphic magazine, every new issue brings him another reminder of Christmas—and another grateful thought for the friend who made so wise a selection.

While we're on the subject of gifts, we'd like to give a little Christmas present ourselves. The regular subscription price of Popular Science Monthly is \$1.50 a year—but, to every reader who wishes to send the magazine as a gift, we'll give our own Christmas present of twenty-five cents, so that, for each friend to whom you send Popular Science Monthly on this special occasion, you need send only \$1.25 instead of \$1.50. Here, however, is a gift you cannot measure by cost, because it is so very inexpensive—and yet its worth in terms of interest and genuine pleasure for the gift receiver is invaluable. And, to carry out the spirit of the season still further, we shall mail to every friend to whom you send Popular Science Monthly as a Christmas Gift, an appropriate Christmas Card, bearing your own name and your good wishes, and telling him Popular Science is coming as your gift.

If you want to send a gift that means something—and, if you want to avoid the discomforts of last-minute shopping in crowded stores—Popular Science Monthly is certainly the solution to this year's gift problems—for every man on your Christmas list. Use the convenient order blank, sending your remittance now or indicating below that you wish to be billed for the amount after the Christmas Holidays—and mail it back to us today.

## POPULAR SCIENCE MONTHLY

381 Fourth Avenue New York, N. Y.

Send Popular Science Monthly for one year on your special Christmas offer of \$1.25 for a year's subscription to the names written below—and also send a Christmas Card bearing my name and greetings for each separate gift subscription.

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# *I really don't know if I should smoke...*

...but my brothers and my sweetheart smoke, and it does give me a lot of pleasure.

Women began to smoke, so they tell me, just about the time they began to vote, but that's hardly a reason for women smoking. I guess I just like to smoke, that's all.

It so happens that I smoke CHESTERFIELD. They seem to be milder and they have a very pleasing taste.



*the Cigarette that's Milder*

*the Cigarette that Tastes Better*